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Electrical World

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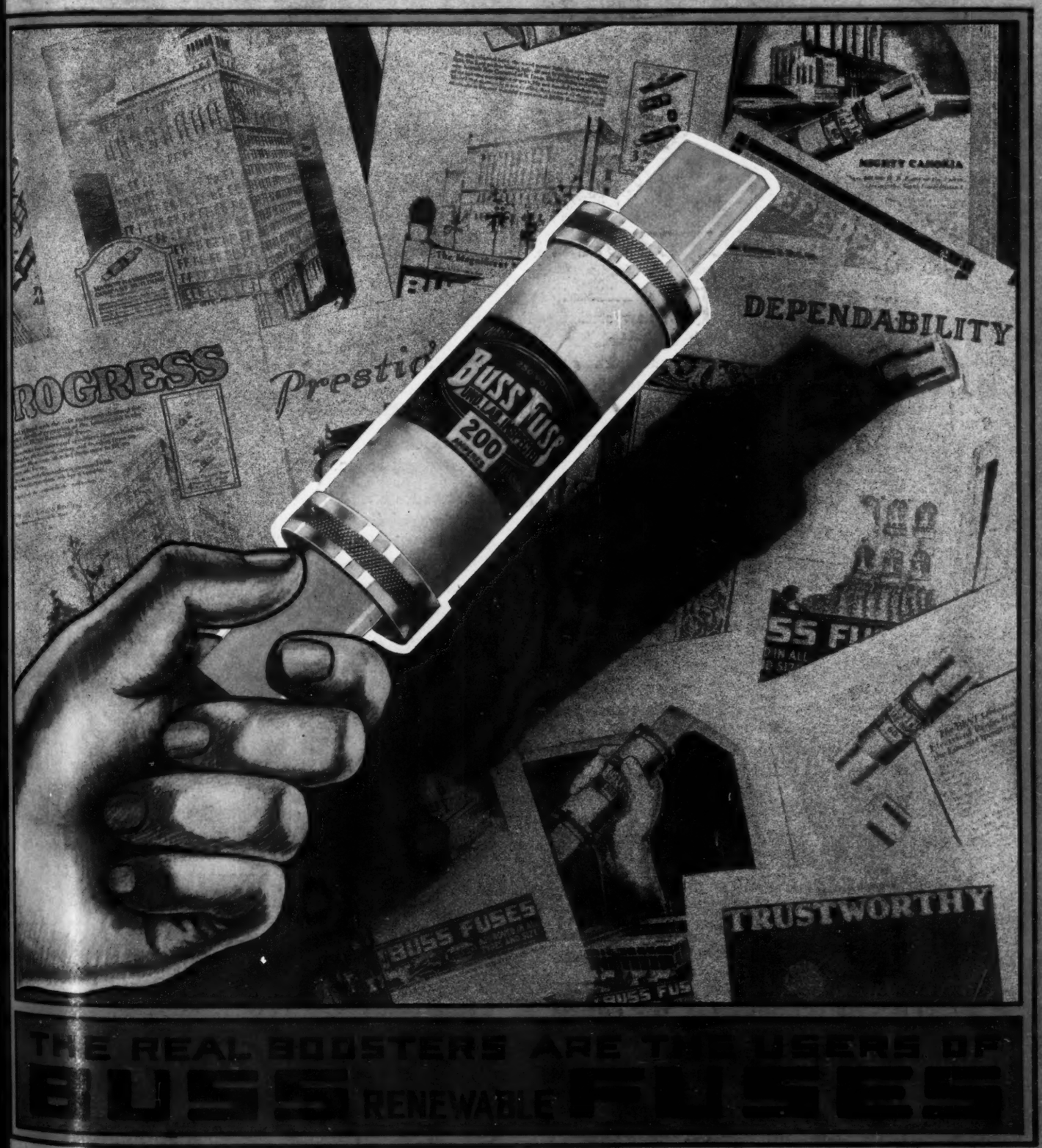

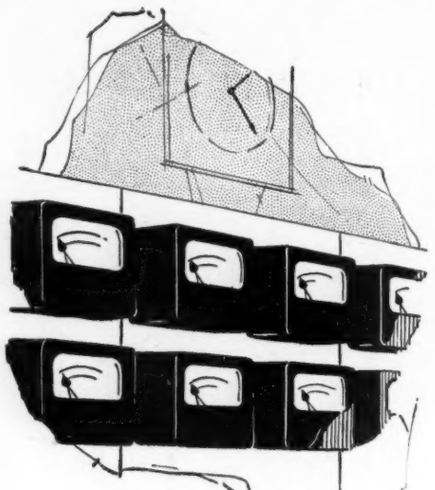

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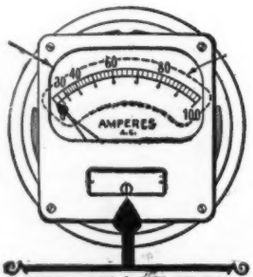

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Weston Rectangulars represent space economy over round type instruments—even Westons—and give very much better scale characteristics, such as scale visibility and easy reading.

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THE switchboard design engineer, responsible for laying out new station equipment which represents the most modern practice, should ever be ready to give consideration to equipment which will bring commendation from those who own and supervise the project.

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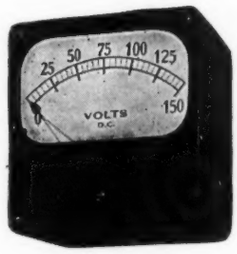
Weston Rectangulars are the modern instruments for the modern switchboard. Their unusual performance records, dependable accuracy, exceptionally low power consumption and low upkeep costs, explain the reason for their widely extended acceptance and application.



Special features are: 1—can be used on metal panels without special provision for insulation; 2—Standardized drilling and mounting; 3—Unusually wide scale openings, affording great legibility; 4— Removable case without instrument dismounting—and many other perfections which add to the flexibility and simplicity of their use.

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Electrical World

Published by McGraw-Hill Publishing Company, Inc.
W. H. ONKEN, JR.
Editor

VOLUME 90 — *New York, Saturday, August 27, 1927* — NUMBER 9

Opportunity for Electric Household Appliances

IF ONE were to ask one-thousandth of one per cent of the inhabitants of a country definite questions, would he be justified in concluding that their replies would hold true for the remainder of the population? Hardly. If asked to designate a city which would be typical of the United States, would you choose Zanesville, Ohio? Yet a survey of that city and thirty-six other communities from Maine to California has been made the basis of general deductions regarding the American home. In all 11,232 interviews took place, and since 70 per cent of the homes in Zanesville were visited, the other thirty-six communities could not have been canvassed very thoroughly. Nevertheless, the results are very interesting and complimentary to the electrical industry, even though they cannot be accepted without a generous dose of salt.

The survey indicated that 74 per cent of the homes in Zanesville are equipped with electricity while 97 per cent of the homes in the thirty-six other communities visited were wired for electricity. This should be compared with other information gleaned in the survey to the effect that 92 per cent of the homes used gas, 95 per cent had running water, 40 per cent had automobiles, 80 per cent had telephones and 26 per cent possessed radio sets. Compared with Zanesville, the specific use made of electrical apparatus in the other communities was as follows: Refrigerators, Zanesville 0.4 per cent, others 1.7 per cent; sewing machines, Zanesville 2.6 per cent, others 7.8 per cent; toasters, Zanesville 19.7 per cent, others 35.7 per cent; fans, Zanesville 9.4 per cent, others 19 per cent; washers, Zanesville 2 per cent, others 29 per cent; irons, Zanesville 59.2 per cent, others 82.2 per cent; vacuum cleaners, Zanesville 52.6 per cent, others 59.8 per cent. More curling irons were used than percolators, grills, hot plates, pads and water heaters, the general use of the latter devices being well below 10 per cent and still lower in Zanesville. All of which goes to show that there is still a very great opportunity for the introduction of electric household devices throughout the country; for with so great a proportion of wired houses the number of appliances in use is lamentably small.

Replacement Values and Labor Waste

LABOR, machines and power fashion generating stations, swift motor cars and tall buildings from earth and ore and coal, but always, fundamentally, it is the labor of men which produces the necessities and comforts of our life. Today five men can accomplish what twenty did but a few years ago. Tomorrow, be assured, still fewer will be required. But what of things built today with a waste of labor? The power house erected at an excessive cost because of loafing workmen and inefficient supervision is not intrinsically worth more than if it had been built in accordance with our abilities and knowledge. If financed by the sale of securities, the bondholders have a mortgage on an overvalued thing, the stockholders have an equity strangely impaired. The utility company must pay interest charges on, and for, something that it did not get. The funds have gone to the workmen's pockets with consequences potentially more dangerous than if there had been an equivalent gift to them of so many dollars. Who is the loser? Not the bondholders, but the utility, its stockholders and those to whom it supplies service. The companies with low construction costs and consequently lower interest charges than their wasteful contemporaries will possess a measure of merit when the day of reckoning arrives.

New England Rate Situation Improves Steadily

WEEK by week the New England central-station rate situation progresses toward greater stability as operating companies establish and test the value of promotional type schedules of prices for service. There is no denying that the Northeast has been a storm center of rate discussion and political agitation associated therewith in the very recent past, but at present the outlook is better than might have been expected after the upheavals of the late spring in legislative circles and the now celebrated Worcester decision of the Massachusetts commission. Company after company has become convinced of the equity and usefulness of inducement-type rates, and while it remains to be seen whether all such rates proposed will prove acceptable and economically justified, it can hardly be questioned that this tendency marks the coming of a new era in public relations.

It would be foolish to spotlight any one type of promotional rates as a cure-all in the face of the few years' experience the industry has had with inducement tariffs. Nevertheless, the evidence multiplies that through the application of a carefully considered form of schedule which enables the consumer to buy energy at relatively low prices per unit once the overheads are covered, use per customer will mount faster than under a standstill policy. The good effect of these relatively low energy rates upon the public mind is manifest. Such rates are the chief stock in trade of the municipal plants, regardless of how they are derived or justified, and their impression upon the ordinary citizen who displays small interest in the problems of the electrical industry is not to be overlooked. It is therefore significant of managerial responsiveness to progressive ideas that energy charges of from 3 cents to 5 cents per kilowatt-hour are being offered in the "follow-on" sections of these new rates. In some cases the area charge is being utilized to meet the initial overhead, in others the room rate, and elsewhere the service charge is being put into effect, or even the former maximum rate per kilowatt-hour is being applied over a narrow block of usage; but in all

instances the managements are alert to the advantage of reaching the lower brackets of pricing as soon as may be in order to encourage the maximum use of light, heat and power by the vast list of small customers which has in so many cases represented little else than dead wood on the system.

Proceedings pending in the courts to establish the constitutionality of commission findings are of great importance, but, however these may eventuate, the inducement type of rate is not likely to lose its attractions as the most promising method yet attained of encouraging greater use of electricity and so reducing unit costs. New England is, of course, not at all unique in this trend in rate making, but it is very significant in its effect upon public relations and company prosperity under the conditions prevalent in the Northeast this year.

Safety Factors in Substation Design

GRATIFYING trends toward the design of substations to facilitate safer operation are apparent. There is no royal road to safety over which the engineer can pass without pausing to weigh and consider conflicting factors arising from space and cost limitations, but close study of recent installations reveals progress in the right direction. The advance of interconnection, development and application of supervisory control for use in remote and scattered installations, rerouting of lines in the outskirts of cities to meet increasing and changing loads—these and other elements in the situation are bringing the safety problem and the allied question of insuring continuity of service very much to the front.

More attention is being paid to the location of substations with respect to fire hazards from neighboring structures and to the isolation of the effects of short circuits inside such establishments. Temporary feeders are giving way to aërial cable or underground lines, and makeshift roof structures are being superseded by solid construction. In installations in the outskirts the lower value of real estate is permitting better spacing between step-down transformers, circuit breakers, lightning arresters and switch houses. Within these last one can see that the designing engineer is putting no little thought upon the simplification of bus structures, copper ties and lower-voltage switch cells. The importance of adopting standard installations in all the high-tension substations of a system is coming to the front, notably with respect to the disposition of live parts of circuits and equipment and the symmetrical arrangement of disconnecting switches and other apparatus.

Lack of symmetry and irregularity of arrangement are fertile causes of operating hazard on systems where inspection and maintenance forces are shifted around a good deal, for with the utmost care habit is strong and uniformly safe spacings and dispositions of bus leads, ties, current transformers and other material deserve to be adopted wherever possible. There seems to be no such thing as finality in the design of even a so-called standard suburban substation to serve a populous community from a "high line," but the value of solid construction with a keen eye to future developments is more and more apparent. In this connection some operators are severely criticising the use of cast concrete blocks in switch-cell walls, contending that the presence of voids often makes the keeping up of alignment difficult in fixtures for cell doors and hampers other attachments.

High-Tension Cables in Service

COMMERCIAL and experimental installations of 132,000-volt cable have been made in New York, Chicago and New Jersey. An enormous amount of research and development have been involved, and the service outcome of these installations will have a great influence upon the development of light and power systems in this country. High-voltage cables will save money for the industry and improve service if they operate successfully. With their use interconnections of million-kilowatt generating stations can be made economically and tremendous savings can be made in underground installation costs. High-tension transmission lines may enter or leave metropolitan power stations without many of the present cost and legal handicaps. Outdoor high-tension switching stations and substations can use the cable to save money by the elimination of costly overhead construction for internal substation connections. A real service has been rendered by the utility companies and cable manufacturers that have developed the new cables, and it is to be hoped that the cables will give service records which will justify their acceptance as good practice by the entire industry.

It is not to be exjected that the present cables will prove to be the final form or the most desirable to operate. The greatest objection to present types is the abundance of insulating oil used in the cable and its accessories. This offers a hazard and involves high inspection, installation and maintenance costs. Further study of the dielectrics and further developments in manufacture undoubtedly will enable the engineers to overcome many objections to the present cables. But even as they are, if they give the service expected of them, they will mark a notable economic and engineering achievement.

The Singing Contractor—A New Thought in the Industry

THE singing soldiers of Italy contributed one of the most romantic touches of the great war. High up in the Alpine fastnesses, they literally sang themselves to victory. It is a stirring thought. For human hearts still rise to the primal instinct for exultant self-expression in communal song despite the dominance of science and engineering in our modern workaday lives. It is not unnatural that this instinct should burst forth under the thrill of war, but it is hardly to be expected in the humble walk of the wireman. Yet today the electrical contractors of Lake County, Indiana, are literally singing themselves into prosperity. Here is the story.

Last year at the convention banquet of the Electragists a silver cup was offered in an intercity singing contest. It was purely impromptu amateur warbling. Lake County won. The Lake County electragists serve five factory towns, including Hammond and Gary. They have been beset by all the slings and arrows of the present-day contracting business — including the "squeeze-job" competition of the curbstoner at its very worst—because among the ranks were several foreign-born to whom the American ideas of co-operation had not unfolded. But also there were several wise leaders who knew the heart of man. So, with the apparent motive of preparing to defend the "harmony cup" at coming conventions, the Lake County electragists began

to meet together every month to sing. And they wrote songs, such as "The more we get together the happier we'll be" and "Where, oh, where, has my little job gone?" By paying an attendance fee out of their Lake County association funds they secured the presence of each member and his wife. They found in town an ex-professional and made him song leader. The other night they sang again before the next convention, trained to the minute, every man in evening dress and every man's wife in her best. They sang songs of the trade and won the cup again amid tumultuous applause.

Play with a man and you cannot hate him, though some men are hard to play with. But you can sing with any group that puts its heart into its voice and has a good leader. This was the Lake County psychology, and it has worked. For these electrical contractors, there in Indiana, have succeeded through song in learning to understand and like each other, to be more tolerant and unselfish, to compete fairly both in the moral and the economic sense and to prosper. They might not phrase it just this way themselves, but talk to them awhile—these men and women—and you see. And this is something for the industry to think about.

The Lighting Value of Paint

LONG ago it was found that purely direct lighting was not ideal from the viewpoint of eye comfort. Therefore the ceilings and walls of interiors have played a part of increasing importance as that of lighting has progressed. At the same time, painting and other interior finishes have increased in importance, and they should be included in the considerations of lighting departments that desire to give the customer the best service and advice. A user of light who will maintain walls and ceilings properly will also maintain the lighting installation. He will be the most satisfied customer and will contribute to the progress of lighting. But, having recognized the lighting value of paint, it is also necessary not to overdo this recognition. For example, it has been determined that walls of offices preferably should not have reflection factors exceeding 50 per cent and that a pure white ceiling is not so pleasing as one just "off a white," such as cream. Moreover, contrary to belief, matte paints are just as efficient as glossy ones, collect no more dirt and reflect light better.

It is not difficult to compute how often paint can be renewed and paid for by the saving in light achieved. For example, assume a drafting room having a floor area of 2,000 sq.ft. upon which 16 foot-candles is delivered by an indirect-lighting system and a ceiling of 80 per cent reflection factor. With electrical energy at 5 cents per kilowatt-hour, the cost of energy is 30 cents per hour. If the ceiling reflects only 70 per cent of the incident light, only 14 foot-candles is received. This relatively represents a loss equivalent to 3.7 cents per hour. In 2,400 hours of operation of the lighting system the loss is $90, or the cost of painting the ceiling with an 80 per cent paint. It is assumed that there is no accumulation of dirt, which, of course, is far from the case. Taking into account the decrease in reflection factor from dirt accumulation, the unsatisfactory appearance and the loss in production due to the decreased intensity of illumination, it is seen that the economic period between paintings is much less than 2,400 hours of lighting.

Two Demonstrations of Successful "Co-operative Competition"

TWO striking examples in recent years have demonstrated that even activities which considered in the ordinary sense are competitive can be conducted on a harmonious basis to the benefit of both the nominal competitors. One example is afforded by present policies and practices in selling self-contained lighting sets, on the one hand, and purchased power, on the other; the second and more recent example is found in the sale of ice and the sale of electric refrigeration.

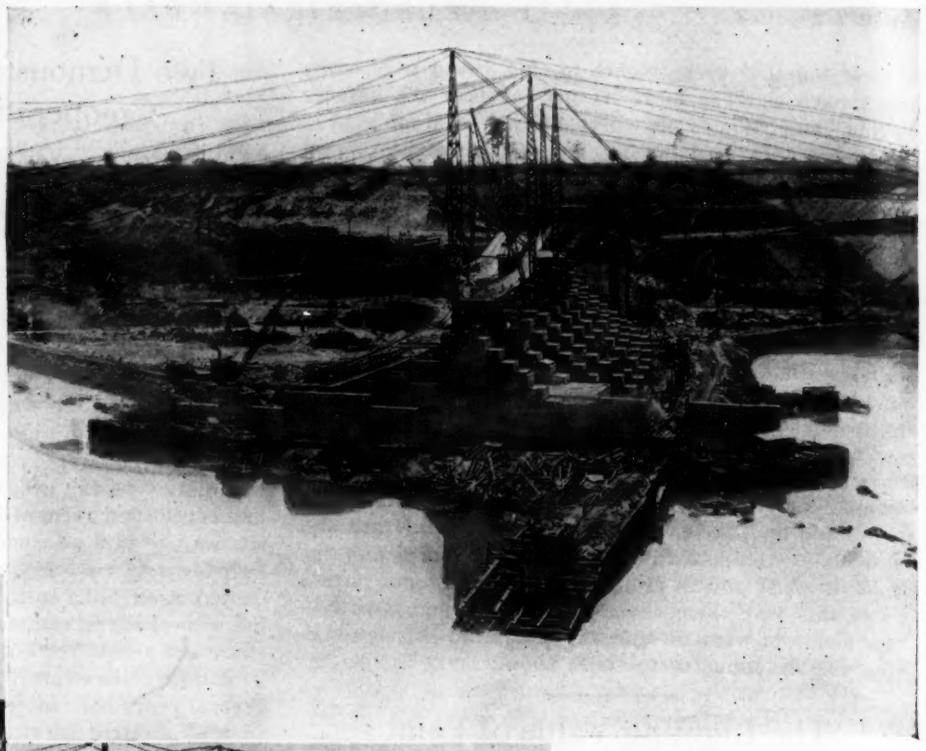
In both cases it was originally held that the rival businesses were highly competitive and that the interests involved were radically opposed. On that antagonistic basis progress in either direction was hampered, and recognition of this fact probably opened the way to real advance. In the case of self-contained lighting sets versus purchased power the question suggested itself alike to the merchants of both: "Have we not something in common on which we can unite, and is there not a field for both services that can be developed by co-operative effort?" The answer was found, and for several years both interests have been selling the mutual idea of electric service first, advocating their own or the other's service according to which would be best for the purchaser in the long run. Both sides have prospered.

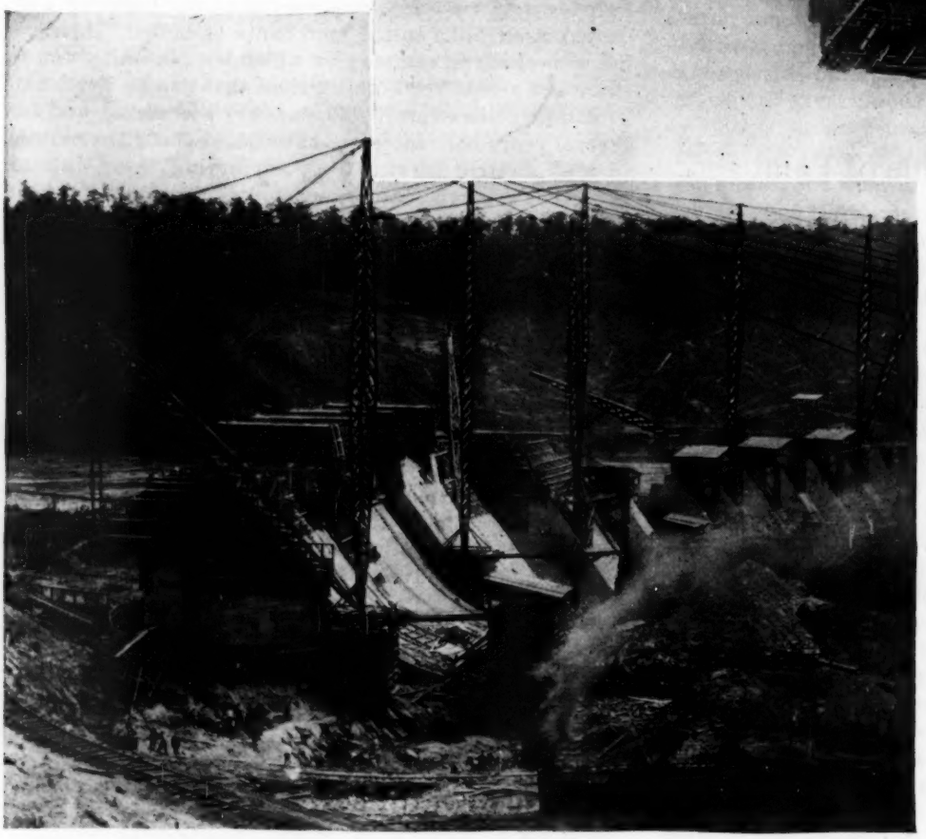
With ice as opposed to electric refrigeration the situation has become much the same—actually competitive when ice is sold in competition with electric refrigeration or vice versa, but completely harmonious when both put the emphasis on the value of refrigeration or better refrigeration. Scattered evidence that co-operative effort in this field has been productive of mutual benefits to one-time competitors was observed in making the recent refrigeration survey. Further support is given to this contention by the following extracts from recent statements of John Nickerson, president of John Nickerson & Company, investment bankers:

> The satisfactory results attained by the ice and refrigeration industry during the year just concluded are attributed in large part to the extensive advertising and merchandising campaigns which have been conducted this year to bring to the public the importance of refrigeration as a modern necessity. . . The annual consumption of manufactured ice is now over 700 pounds per capita, as contrasted with 480 pounds per capita in 1914. . . . It is expected that sales of iceboxes next year will total two million, or approximately a 20 per cent increase over the number of boxes now in use.
>
> A noteworthy accomplishment during the year was the agreement between manufacturers of ice and electric refrigerators to conduct their advertising campaigns along lines which will be of benefit to the entire industry and to co-operate in eliminating any misstatements of fact or any suggestions which might be interpreted as casting reflection on either branch of the refrigeration industry.

Here are two demonstrations that there can be "co-operative competition," with financial success for both sides. Is it not worth while, or even imperative, in other competitive situations to find mutual selling arguments that will stimulate the market for both products or services and then let what is best for the purchaser determine the sale? If this kind of competition can be made industry-wide, then competitors will not only sell their own products more easily, but they will be aided and not hampered by their competitors.

Construction of Lock 18 in Alabama Well Under Way

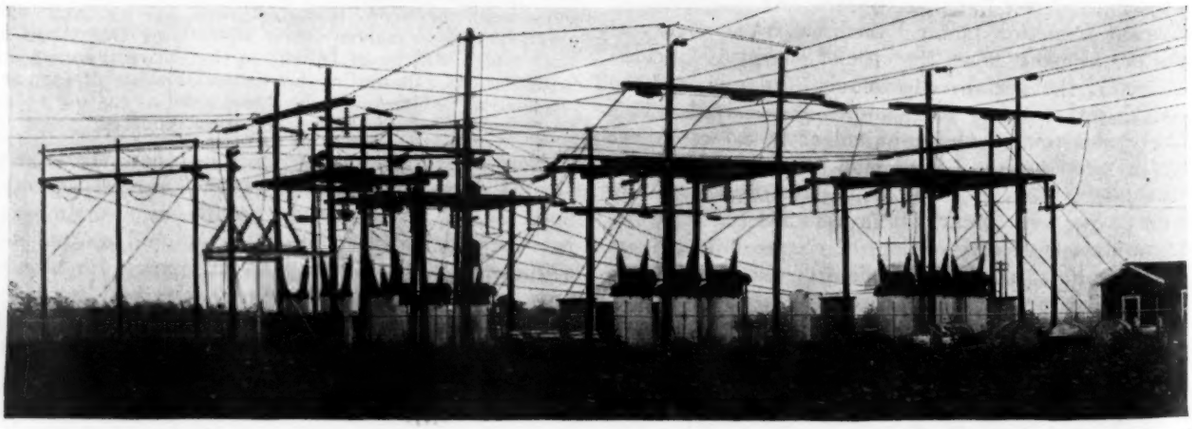




WITH 360,000 yd. of earth and stone excavated on July 1, 1927, out of a total necessary of 470,000 yd., and 70,000 yd. of concrete poured in the dam, where 440,000 yd. is required, work on the Lock 18 project of the Alabama Power Company, on the Coosa River, is progressing rapidly. The power house will contain four units, to be operated under a normal head of 93 ft. with an initial capacity of 144,000 hp. Provision will be made for two additional units, making an ultimate installation of 216,000 hp. The first unit is scheduled for operation in December, 1928.

The first two illustrations are general views of Lock 18.

The illustration below shows the substation at Lock 18, which is one of the main switching points on the Alabama system.



CO_2 Fire-Fighting Equipment

at Long Beach Steam Plant

Carbon Dioxide Gas Proves Effective at Low Concentrations—Special Cutter Heads Are Solenoid Operated and Gas Is Released Automatically by Motor Mechanism

By J. C. Gaylord

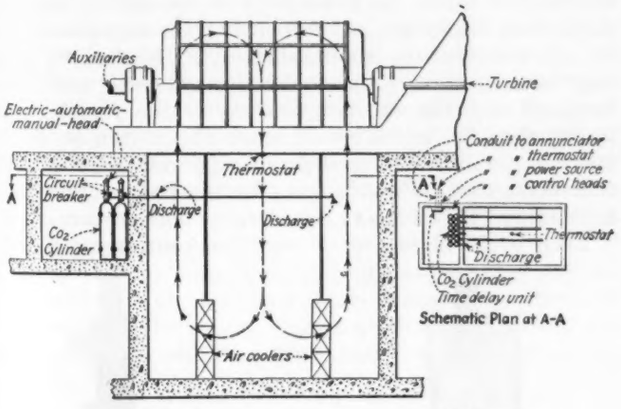
Department of Engineering Design,
Southern California Edison Company,
Los Angeles, Cal.

CONTROL HEAD THAT FITS OVER SAFETY CAP AND DISK ON CO_2 TANKS

The cutaway view of the control head shows the spring (A) compressed and the cutter (B) in position ready to be released by the solenoid. The solenoid in this case is for operation on 125 volts direct-current and draws 4½ amp. When the direct-current circuit to the solenoid is completed, the solenoid is energized and operates the release mechanism, allowing the compressed spring to drive the steel cutter downward and puncture the safety disk. The cutter is driven with sufficient force to cut several disks.

THE selection of carbon dioxide gas as the best means of extinguishing fires in large generators at the Long Beach station No. 2 of the Southern California Edison Company was the result of careful study and a series of tests. Due consideration was given to the various devices and substances now available for the prevention and extinguishing of fires, but none possessed the marked advantage of carbon dioxide gas, particularly where it can be injected into a relatively tight chamber or system of ducts. The gas used is very effective at reasonably low concentrations, is not in the least damaging to insulations, metals or fabrics, leaves no residue and is not injurious to life except in highly concentrated mixtures, besides being very easily handled and requiring little attention.

The three generating units at Long Beach steam plant No. 2 are identical in form, but two are rated at 39,000 kva. and one at 55,000 kva. They are cooled by



ARRANGEMENT OF CO_2 FIRE-FIGHTING EQUIPMENT AT LONG BEACH STEAM PLANT

air circulated through surface-type coolers by fans on each end of the rotors. The air enters each end of the generator, passes toward the center, then downward, where the stream divides and passes through the coolers and returns by separate ducts into the ends of the generator again, thus completing its cycle. Into this closed system the CO_2 is injected.

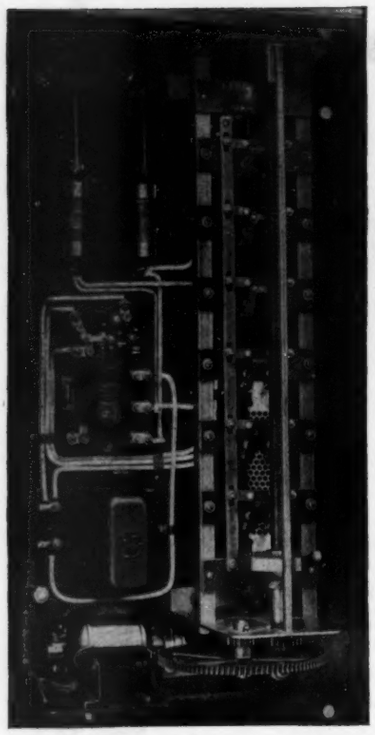
The CO_2 used is manufactured and bottled by the Pure Carbonic Company, each cylinder containing 50 lb. of liquid carbon dioxide, which makes 450 cu.ft. of gas at normal temperature and pressure. The gas is chemically pure, being free from all moisture, sulphurous compounds, carbon monoxide and aldehydes. A small amount of wintergreen is compressed with the gas to aid in the detection of possible leaks.

The discharge outlet of each cylinder is sealed by a special safety cap and disk, which renders a leak almost impossible, all valves being eliminated. A heavy screw cap with a ⅜-in. hole in the top is run over a male thread on the top of the cylinder and seats the metal disk over the outlet with such force as effectively to seal the cylinder against any pressure* up to that required to burst the metal disk. Thus the only way to release the gas is to puncture the disk. A cylinder of CO_2 will discharge in 20 to 40 seconds when released by cutting the safety disk.

Long Beach Installation

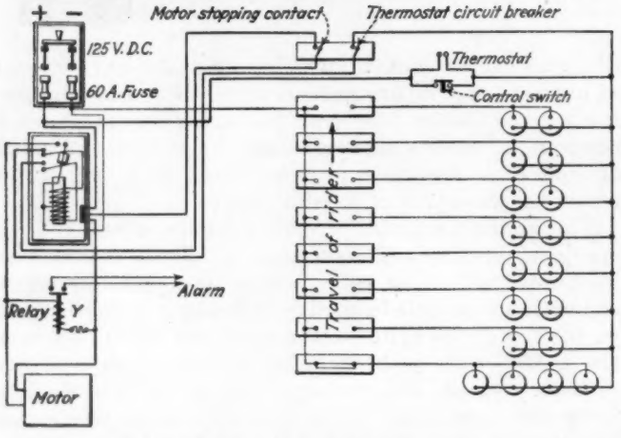
Each cylinder at the Long Beach plant is equipped with a control head, which is operated either by hand or by a solenoid. This control head consists of a brass shell 3½ in. in diameter, with a total height of 24 in. In it is mounted a steel cutter, a solenoid, a spring and a release mechanism. For the purpose of discharging the tanks manually, a plunger protrudes from the top of the control head which when struck operates the release mechanism exactly as it is operated by the solenoid. The control head is mounted directly on top of the CO_2 cylinder and the assembly is called a CO_2 unit.

*The pressure at which the safety disk bursts is specified by the United States Bureau of Explosives. The disk is so designed that it will break and release the contents when the temperature of the cylinder reaches 135 deg. F., at which temperature the pressure is 2,700 lb. per square inch. The cylinders are tested and inspected by the manufacturer before and after each filling and at periods not exceeding five years in event they have not been discharged, each cylinder being tested to 3,000 lb. per square inch hydrostatic pressure.



TIME-DELAY UNIT WHICH AUTOMATICALLY RELEASES CO_2 GAS

Consists of a motor-driven contactor and a relay. The contactor is driven at a uniform rate over a series of contacts, which are mounted on a rack and held in position by set screws. The distance between contacts can be varied at will and determines the time interval between discharges. The contactor always stands set on the first position, which is for the initial discharge. After the last discharge is fired, a final contact is provided by which the current operates the motor-control relay and stops the motor. This unit is mounted near the cylinders and is entirely inclosed in a metal box.



Each of the 39,000-kva. generating units is equipped with twelve of these CO_2 units discharging into the air-circulating system, which has a volume of approximately 2,700 cu.ft. The 55,000-kva. generating unit is equipped with sixteen units, the air-circulating system having a volume of approximately 3,600 cu.ft. Four units discharge into each auxiliary generator (4,000 kva.). All the CO_2 units are situated just outside the generator air ducts and each unit discharges directly into the air duct through a separate ½-in. brass pipe. Each pipe is made as short as possible and has no angle fittings, all bends having at least a 6-in. radius.

The number of CO_2 cylinders required for any installation is determined by the total volume of the space to be protected, the percentage of CO_2 required to extinguish fire and the time during which this percentage is to be maintained. An atmosphere containing 17 per cent CO_2 will extinguish any fire, but in order to allow for leakage in the air ducts and to have a reasonable factor of safety the Long Beach installations are designed to maintain the precentage of CO_2 between 25 and 35. The length of time during which the atmosphere of CO_2 should be maintained is largely a matter of personal judgment. It should be maintained until the temperature of the combustible material and adjacent parts has fallen below a point at which, in a normal atmosphere, combustion might be re-established. At Long Beach the installation has been arranged to maintain the percentage of CO_2 noted above for approximately 30 minutes.

Automatic Release and Results

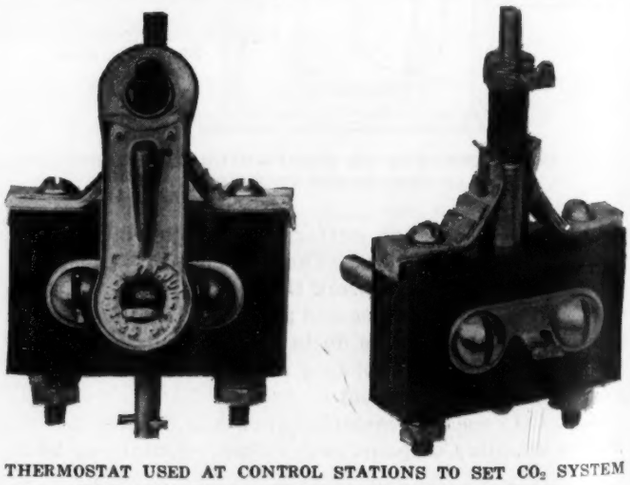
To maintain economically an atmosphere containing from 25 to 35 per cent of CO_2 for 30 minutes, automatic time-delay equipment has been installed. This equipment controls the direct-current circuits to the solenoids in the control heads in such a way as to discharge initially enough CO_2 to bring the percentage to approximately 35 immediately, and at regular intervals thereafter, determined by test, to discharge more CO_2, keeping the percentage above 25.

A test on the 55,000-kva. unit showed that if an initial discharge of six cylinders was made, followed at 4½-minute intervals by five discharges of two cylinders each, at least 25 per cent CO_2 could be maintained for 30 minutes. Although no tests have yet been made on the installations on the 39,000-kva. units, they have been set for an initial discharge of four cylinders and four subsequent discharges of two cylinders each at 3½-minute intervals. This time interval may be somewhat increased after the installations are tested.

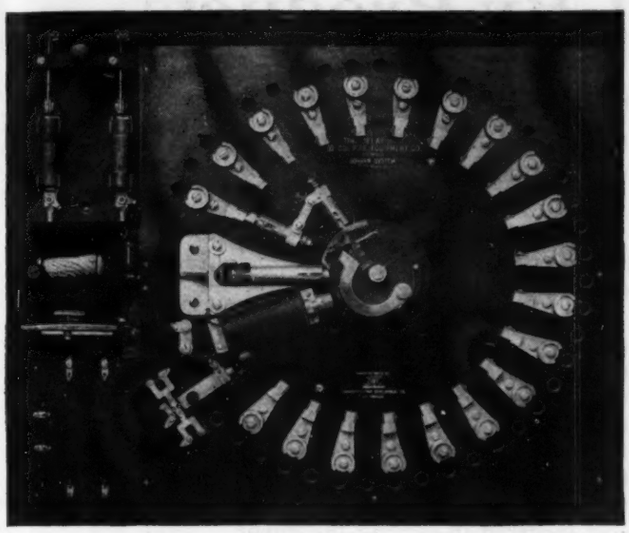
Thermostatic Control

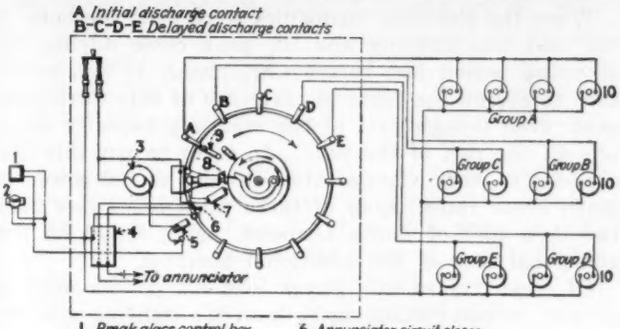
As may be seen from the wiring diagram, the time-delay unit may be set in operation from any number of conveniently located control stations. Thermostats and break glass control boxes are used. The thermostats consist of small single-pole switches held open against a spring pressure by a fusible link designed to release at 160 deg. F. In the Long Beach installations these thermostats (one for each generator) are placed several feet below the generators in the central part of the hot-air discharge. At full load on the generators the hot air temperature is somewhat over 100 deg. F., and therefore in case of fire only a short time would be required to bring the temperature of the fusible link to 160 deg. F., which would allow the switch to close, making the initial discharge of CO_2 and starting the time-delay unit. Fusible links for the thermostats may be obtained that fuse at any desired temperature.

Each break-glass control box also contains a single-



THERMOSTAT USED AT CONTROL STATIONS TO SET CO_2 SYSTEM INTO OPERATION. FUSIBLE LINKS HOLD SWITCH IN OPEN POSITION





LATEST TYPE TIME-DELAY CONTROL SYSTEM FOR RELEASING GAS CYLINDERS

pole switch, but it is held in the open position against spring pressure by the glass window until broken.

In the latest design of time delay units the wiring is such that tampering with the break-glass boxes or damaging of the thermostat will not stop the functioning of the equipment after it has once started. The only means of stopping it is to open the main direct-current supply circuit, which will consequently stop the discharging of the cylinders.

A time-delay unit, a thermostat and two break-glass control boxes are provided for each main and auxiliary generator. One of the control boxes is located on the turbine floor and the other near the time-delay and CO_2 units.

Developments Since Installation

Since these installations were made at Long Beach the CO_2 Fire Equipment Company, which made all of the equipment described, has developed a time-delay unit that has several advantages over the one described. Besides being more rugged, this new unit can be arranged to control more than one group of cylinders, as might be installed for the protection of a frequency changer set or a motor-generator set. In such installations this new unit will operate either group of cylinders or both groups simultaneously.

Serious consideration has been given to the possibility of so connecting the time-delay unit with the differential protection of the generating units that in case the generator is tripped off the line by the differential relays, the CO_2 equipment will be started in operation. So far no installations have been connected in this way, but it is quite probable that this system will be used in the near future. Inasmuch as the cost of the CO_2 is comparatively small and the possible saving by immediate discharge in case of generator trouble is great, this method of control has much to recommend it.

It was thought at first that the cooling effect of the CO_2 discharge into the air-circulating system of the generators would be considerable. A test on the 55,000-kva. generating unit, however, showed that this was negligible, due to the very great heat capacity of the generating unit. The temperature in the air ducts was lowered only 3 or 4 deg. for a very short time by the introduction of the CO_2.

So far the Southern California Edison Company has had no actual experience with this system in the extinguishing of generator fires, but it seems reasonable to believe that if outside sources of energy are cut off from the machines the CO_2 will prevent any combustion of material within the generators.

Water-Power Plants Reached a Capacity of 11,721,000 Hp. in 1926

WATER-POWER plants in the United States reached a total capacity of 11,721,000 hp. in 1926, the year closing with an increase of 544,000 hp. over 1925, according to the report of the water-power development committee of the N.E.L.A. There was less completed development in 1926 than in 1925 or 1924 or 1923, but more than in any other preceding year except 1913. Moreover, the increase in capacity was above the average 460,000 hp. a year. The total output reached 26,188,801,000 kw.-hr., or slightly more than 35 per cent of the total energy generated in American central stations. This was an increase of 17 per cent over 1925.

More than 70 projects were under construction when the year ended, calling for approximately 1,100,000 hp. in 1927 and 875,000 hp. in 1928. The Federal Power Commission reports that 102 new applications for permits or licenses were filed in 1926. The 60 applications for preliminary permits represent an estimated installed capacity of 4,632,000 hp. and the 25 applications for licenses for major projects 1,323,000 hp.

Development of the Colorado and St. Lawrence Rivers is still held up. The committee attributes delay in the development of the Colorado to the apparent determination of public ownership enthusiasts to limit development, at least on the lower river, to the plan set forth in the Swing-Johnson bill. As to the St. Lawrence, action continues in suspense awaiting the report of the consulting engineers to the International Joint Commission and the adoption of a general scheme of development acceptable to the United States, to Canada and to the State of New York.

The number of applications rejected (nearly 50 per cent) indicates that the commission has acted with discretion and caution in considering proposed hydro developments.

An outstanding event of 1926 was the exercise by the Federal Power Commission for the first time of its power to regulate the issuance of securities by corporations engaged in the development of licensed projects.

Veal, Hide and By-Products

A Dissertation on the Fertile Subject of Cost Allocation—Many Men Propose Many Methods and Common Sense Is Needed as a Modifier

By Charles S. Reed
Consulting Engineer, New York

THE butcher he killed a calf, a nice, young, adolescent bull. Being a modern butcher, he then called upon his engineer, his secretary and his figurers three to appear and perform a cost allocation upon the carcass.

"What price veal?" quoth he, "and what price hide? How much did the meat on this animal cost me? How much did the hide cost in its present undressed state? My rate of profit must be the same, too, on the bones and hoofs, so tell me the cost per pound of each."

Thereupon and for many days thereafter the figures flew freely. The bull was spread upon the dissecting table and treated from every angle and by every method. And finally the city health authorities came and carted them all away.

There has been a lot of good bull used up in allocations, but the original bull remains unallocated. Hide and veal, horns and hoof still sell according to the market and without regard for anything except the over-all cost. Sometimes, according to Mr. Brookhart, without even any regard for that.

Of course in the finished products we can separate the cost of special feed used for fattening purposes, the cost of curing the hide and tanning, but the bulk of the cost remains to be divided according to what the traffic will bear.

Changing our subject from meat to "juice" and gas, we find that in a public utility cost allocation the same principle should be given plenty of consideration. Immediately we hear objections, some claiming the gas and electric companies are monopolies and therefore should be treated differently; others claiming an electric or gas utility has only one product to sell, kilowatt-hours or cubic feet, and therefore is not comparable with our combination of veal, hide, etc. Still others shy at the use of the term, "What the traffic will bear," this being generally interpreted as the most that can be extorted from a supposedly downtrodden and unprotected public.

TABLE I—ORIGINAL FIGURES FROM MR. HILLS' ARTICLE

	Kw.-Hr.	Kw. Demand	Kw. On Peak	Demand Costs per Hills	
				Total	Per Kw.
A	600,000	10,000	10,000	$34,410	$3.44
B	1,800,000	8,000	8,000	30,600	3.82
C	1,440,000	2,000	2,000	10,000	5.00
D	3,000,000	5,000	.....	20,820	4.16
E	600,000	10,000	.....	4,170	0.42
	7,440,000	35,000	20,000	$100,000	

More bull, the monopoly idea, but that is another story, dealing with sales rather than with costs, and can be omitted here. As to products, every electric company sells two, kilowatt-hours and a delivery service, which is equally as important as the first product. As to the third objection, considering that a utility is limited in its earnings to a fair return, our expression can be changed to "what the traffic can most easily bear"—that is, the best way of distributing a given burden of cost incurred in serving the public.

When the electrical companies were new, the bulk of the load was lighting and the peak came during the shopping period just before Christmas. It was necessary to design the plant to take care of this Christmas peak, even though part of the resulting capacity stood idle all the rest of the year. In order to put this idle capacity to work, the operators decided to sell power at much lower rates, many of these rates being less than the then cost of doing business, being based on the additional cost of the additional business.

Of recent years this power load has grown until it is now, in many cases, more than the lighting and the peaks come in the morning instead of at night. The lighting load is now off-peak load for such companies. One of the effects of this change has been to upset many of the cost analyses that are supposed to be back of our rate structures.

Recently the Public Service Commission in a neighboring state sent an order to each of the electric companies for a detailed report showing the rate of return on each class of business. In many cases such a report will show a high rate of return, 12 to 16 per cent, on the lighting load and a low rate of return on power. There is the possibility of it being used, therefore, to cut lighting rates at the expense of the power users, for the benefit of certain politicians and to the ultimate detriment of the lighting customers themselves.

Discussion of Cost Allocation Methods

Recently there have appeared in the Electrical World articles telling how the costs of doing business should be segregated among the various classes of loads served by an electric utility. Chief among these articles is one by H. W. Hills, which appeared in the issues for Jan. 22 and 29 of this year and which won the Henry L. Doherty prize for 1926. One hesitates before criticising a paper that was evidently passed upon by some of the leaders of our industry, but the theory expressed appears to the writer not only unsound but also unsafe, especially if used by the aforementioned type of politician.

In his article Mr. Hills discusses the various methods of allocating demand costs—peak responsibility, kilowatt-hour ratio, summation of demands and the theories of Messrs. Eisenmenger and Greene. These other meth-

ods are apparently disposed of by Mr. Hills in no uncertain terms, and so will not be gone into in detail here.

To simplify matters, the illustration used in explaining the phantom customer method of Mr. Hills has been continued in this article. Thus, if Mr. Hills or either of the other gentlemen wishes to take a return

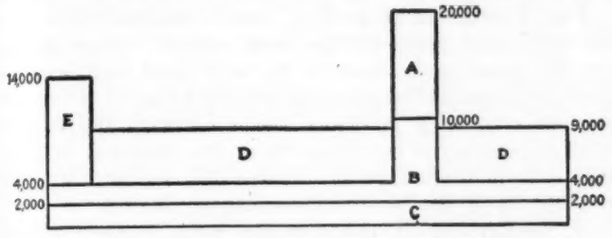


FIG. 1—TYPICAL UTILITY CUSTOMERS FOR COST ALLOCATION STUDIES

wallop at me, they will not be hampered by the use of new and untried figures.

Fig. 1 is taken directly from the article by Mr. Hills, being repeated here for the convenience of the reader. Table I, covering the load curve of Fig. 1, is also taken from Mr. Hills' article, except that there has been added the demand costs per kilowatt for each customer group.

A comparison of this new column of Table I with the facts as shown by the load curve immediately raises a question as to the desirability of the phantom customer method. We note that Customer D, in addition to being assessed with his commodity costs, is also assessed with the second highest demand cost per kilowatt. On the other hand, Customer A, the least desirable customer of the group, is assessed with the next to the lowest charge per kilowatt. Mr. Hills makes it plain in his article that he is not trying to replace acceptable commercial methods for developing the use of central-station energy, but he does say (page 252, ELECTRICAL WORLD, Jan. 29, 1927):

"The results of this phantom method enable us to know definitely what an off-peak customer should pay if he is to pay a fair and just charge for the use of the company's generating, transmission, substation capacity, etc. If he pays more than this cost, in addition to the other costs of service, then we know that he is a profitable customer. If he pays less, *he is not paying his just share of expenses*, but he may still be profitable to some extent if he pays more than the variable charges."

Therefore we are justified in assuming the demand costs arrived at by Mr. Hills should, in his opinion, be used to a considerable extent in fixing rates. Yet his table would give a manager the immediate impression that the most desirable new customer would be one like Type E, with Types A, B, D and C following in the order named. The load curve, however, indicates Customer D as the most desirable and certainly puts Customer C on a par with Customers A and B.

Another way of looking at the picture is as follows: Suppose we have a prospective new customer, D-2, whose load characteristics are the same as D and who will use the same amount of energy. We know that to serve this customer will not require any more equipment and that anything we get as earnings over and above commodity and special costs will be velvet. Suppose, therefore, we offer this customer an off-peak rate involving a demand charge of, say, $10,000. The customer accepts and then we ask Mr. Hills to analyze our demand costs by his phantom method. Immediately he shifts $20,820 of demand costs from A and B to D-2 and tells us, as italicized in the previous paragraph, that if D-2 pays less, he is not paying his just share. Conversely, unless we then reduce the rates paid by A and B, we shall be making them pay more than their just share. What beautiful material for politicians who want to cut lighting rates and raise power and heat-treatment rates in order to capture votes!

So much for the danger of the phantom customer method, the same criticism applying in an even greater degree to the Greene and Eisenmenger methods. Besides this, all three have other faults, some of which become apparent when the methods are carried to extremes. For instance, when a company that has a 100 per cent load factor is considered, the demand cost under all three schemes is assessed to the groups on purely a commodity basis, at so much per kilowatt-hour. A rate maker, therefore, could not justify a demand charge in such a case.

Now, how does this work out in actual practice? One of the Niagara Falls power companies has a load factor of almost 100 per cent. According to Messrs. Eisenmenger, Greene and Hills, this company would have no demand costs and therefore could justify no demand charge. Actually, however, the high load factor was brought about through the fact that the company, *having practically no commodity costs*, put its rates entirely on a demand basis and charged a flat rate of so much per horsepower per year, regardless of consumption. Would any of the three gentlemen recommend to the Niagara Falls company that it base its rates in the future upon his cost analysis methods, and charge only on a straight meter basis of so much per kilowatt-hour? Obviously, if that were done, the 100 per cent load factor would quickly disappear.

One comes to the conclusion, therefore, in following any one of the three methods, that the closer the com-

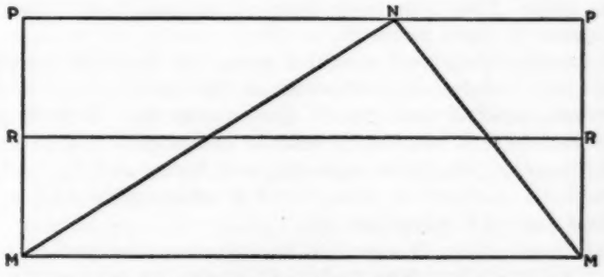


FIG. 2—ALL 100 PER CENT LOAD FACTOR CUSTOMER COSTS SHOULD NOT BE ALLOCATED PRO RATA ON A KILOWATT-HOUR BASIS

pany approaches a 100 per cent load factor the less justification it has for demand charges and accordingly the less encouragement it will offer to good load factor business and the harder it will be for the company to improve its load factor. Just like climbing a hill by taking two steps backward for every one forward.

In regard to a 100 per cent load factor plant, Mr. Hills says (page 250, ELECTRICAL WORLD, Jan. 29, 1927): "In this case a fair and just division of cost will be on a kilowatt-hour basis, for every little block of energy used is just as important as every other block of the same size as far as cost to the central station is concerned." Upon this statement and similar

ones the entire theory of the phantom customer method is based and an examination of Fig. 2 will show that the statement is decidedly in error.

Suppose Mr. Hills has a plant operating at 100 per cent load factor, the load curve of which is represented by *MPPM* of Fig. 2. Also suppose he is threatened with the loss of, for example, 50 per cent of this load. If he loses that part represented outside of the triangular load curve *MNM* of Fig. 2, the phantom method will develop a demand cost. If, on the other hand, the same number of kilowatt-hours is taken off evenly, as represented by the upper half of Fig. 2, outside of *MRRM*, Mr. Hills will continue to allocate costs on a kilowatt-hour basis, encouraging poor load factor business. This illustration will hold true if one-fourth, one-tenth or one-hundredth of the total load is considered, instead of the one-half shown in Fig. 2. Obviously, therefore, kilowatt-hours are not equally important, but every little kilowatt-hour has a meaning all its own. Thus the main base of the phantom theory becomes a mere phantom.

Another statement to which exception might be taken is that "energy consumption is the product of two things, demand and time." Technically Mr. Hills may be correct, but practically energy consumption is often the product of spare capacity and time, and in such cases no portion of fixed costs is chargeable and no plant capacity is tied up.

A queer turn is given to the phantom method if it is continued according to Mr. Hills' closing paragraphs, when he discusses two peaks and outlines his method of procedure in such cases. For instance, suppose the manager of the company, basing his rates on the phantom theory of costs, makes a low rate for Type E customer and succeeds in adding 50 per cent to that class of business, resulting in the load curve shown in Fig. 3.

Some time during the process the two-peak method comes into effect, and then later, if the peak due to Load E outclasses the old peak, a shift back to the one-peak system will occur. Table II shows the effect of the first part of such a process, calculations being made on both the one-peak and the two-peak basis.

A comparison of Tables I and II shows that when the two-peak method is decided upon, there is a violent shift in the demand costs of Customers A, B and E. Customer E goes in one jump from 42 cents per kilowatt to about $2 per kilowatt. Customer A goes through the opposite procedure, dropping from $3.34 a kilowatt to about $2 a kilowatt. If, upon continued growth, we change back to a one-peak method, E makes another jump to more than $3 per kilowatt and A drops down to 39 cents per kilowatt, 11 per cent of its original value.

Fig. 4 is the same as Fig. 1 with the exception that an additional load, G, has been added. Upon applying the phantom method to the additional load, we find that it occasions considerable difference if G is considered as a growth on B as compared with the results if G is considered as a growth of the business of Customer C or Customer D. Tables III, IV and V show the results of the three different applications.

A comparison of these tables with Table I shows some queer complications.

When the load factor of Customer B is improved by adding Load G, the demand cost per kilowatt for B is increased from $3.82 to $4.50, which hardly seems consistent.

When Load G is added to Group C, as shown in Table IV, we find two customers, CG and D, with the same consumption but with entirely different load factors, yet with the same total demand costs. Customer CG, with a demand of 6,000 kw. off peak and a demand of 2,000 kw. on the peak, is allocated the same total cost of $20,800 as Customer D, who is entirely off peak. Thus the peak customer is charged a less amount per kilowatt of demand than the off-peak customer.

The addition of Load G to Group D, increasing the demand of that group from 5,000 kw. to 9,000 kw., causes a decrease in the demand charge for that particular customer.

The phantom method would charge two off-peak customers the same costs if they had the same total consumption, regardless of the fact that one of two customers might use 1,000 kw. per hour for ten hours, whereas the other used 10,000 kw. for one hour.

If the additional load, G, has a poor load factor instead of a good load factor, it will occasion no difference in Tables III, IV and V unless the resulting off-peak load approaches the maximum station peak in size and the analyst decides to use two peaks. Thereupon a sudden shift in demand costs is made, similar to that explained in Table II. Incidentally, in regard to the

TABLE II—EFFECT OF ADDING 50 PER CENT TO CUSTOMER GROUP E

Based on Fig. 3

	Kw.-Hr.	Kw. Demand	Kw. On Peak No. 1	Kw. On Peak No. 2	Demand Costs Per Hills—Amount One-Peak	Amount Two-Peak	Per Kw. One-Peak	Per Kw. Two-Peak
A	600,000	10,000	10,000	.....	$33,100	$19,200	$3.31	$1.92
B	1,800,000	8,000	8,000	2,000	29,800	21,500	3.72	2.70
C	1,440,000	2,000	2,000	2,000	10,000	10,000	5.00	5.00
D	3,000,000	5,000	.....	.....	20,800	20,800	4.16	4.16
E-2	900,000	15,000	.....	15,000	6,300	28,500	0.42	1.90
	7,740,000	40,000	20,000	19,000	$100,000	$100,000		

TABLE III—EFFECT OF ADDING LOAD G TO GROUP B

Based on Fig. 4

	Kw.-Hr.	Kw. Demand	Kw. On Peak	Demand Costs Per Hills Amount	Per Kw.
A	600,000	10,000	10,000	$29,900	$2.90
B and G	3,360,000	8,000	8,000	36,000	4.50
C	1,440,000	2,000	2,000	10,000	5.00
D	3,000,000	5,000	.....	20,800	4.16
E	600,000	10,000	.....	4,200	0.42
	9,000,000	35,000	20,000	$100,000	

TABLE IV—EFFECT OF ADDING LOAD G TO GROUP C

Based on Fig. 4

	Kw.-Hr.	Kw. Demand	Kw. On Peak	Demand Costs Per Hills Amount	Per Kw.
A	600,000	10,000	10,000	$27,600	$8.76
B	1,800,000	8,000	8,000	26,600	3.32
C and G	3,000,000	6,000	2,000	20,800	3.47
D	3,000,000	5,000	.....	20,800	4.16
E	600,000	10,000	.....	4,200	0.42
	9,000,000	39,000	20,000	$100,000	

TABLE V—EFFECT OF ADDING LOAD G TO GROUP D

Based on Fig. 4

	Kw.-Hr.	Kw. Demand	Kw. On Peak	Demand Costs Per Hills Amount	Per Kw.
A	600,000	10,000	10,000	$27,600	$2.76
B	1,800,000	8,000	8,000	26,600	3.32
C	1,440,000	2,000	2,000	10,000	5.00
D and G	4,560,000	9,000	.....	31,600	3.51
E	600,000	10,000	.....	4,200	0.42
	9,000,000	39,000	20,000	$100,000	

TABLE VI—WEIGHTED PEAK METHOD

Based on Fig. 1 and comparable with Table I.

	Kw.-Hr.	Kw. Demand	Weighted Demand	Demand Costs—Total	Demand Costs—Per Kw.
A.....	600,000	10,000	10,000	$34,200	$3.40
B.....	1,800,000	8,000	8,000	27,400	3.40
C.....	1,440,000	2,000	2,000	6,800	3.40
D.....	3,000,000	5,000	2,250	7,700	1.50
E.....	600,000	10,000	7,000	23,900	2.39
	7,440,000	35,000	29,250	$100,000	

two-peak method and Table III, a question might arise as to whether Customer BG should be charged with his demand share of each peak—that is, the excess of his peak demand in each case over his average demand. Also in applying the phantom method to the case illustrated in Table IV and using two peaks, we would find that in calculating the share of the second peak BG's average demand is 2,500 kw., whereas his maximum at that time is only 2,000. The question therefore might arise as to whether B should be given a credit of 500 kw. as against the amount with which he is charged on peak No. 1.

The same defects that appear in the application of the phantom method also appear in those advocated by Mr. Greene and Mr. Eisenmenger, together with other and serious defects to which attention was called in the article by Mr. Hills. Each of the others goes still further in overcharging the off-peak customer, which is strictly contrary to the theory upon which that customer was probably taken on—namely, that the off-peak customer would use the equipment that would otherwise stand idle and that anything obtained from him over and above commodity costs would be "velvet," to be applied either in increasing the net earnings of the company to a fair return or in lowering the cost to the other customers. It is all very well to collect as much as possible from such a customer, but we go too far when we say, as do Messrs. Greene, Hills and Eisenmenger, that the off-peak customer D is a very expensive customer. To say that such a customer has a monopoly on the use of certain equipment during certain hours of the day is as foolish as saying that I have a monopoly on Bill Jones' girl if Bill permits me to call on her when he does not have a date.

Weighted Peak Method

Having thus panned my fellow figurers to my heart's content, it will be only fair for me to set up something for them to demolish. The following method was designed in the hope of correcting some of the defects of the others. However, it is far from perfect, even in the opinion of the writer, and it also fails to stand certain tests that were applied to the other methods.

For lack of a better name, we will call this scheme the "weighted peak method," demand costs being allocated to the various classes of business according to the share of each class in the total weighted peak. The weighted peak of any class of business is taken as equal to the demand of that class at the time of the plant peak plus a share of the excess of the maximum demand of that class of business over its demand at the time of the plant peak. This share that is added is the ratio of the plant demand at the time of the class maximum demand as compared with the total peak demand.

This sounds rather complicated, but is easily understood when applied to actual cases. For instance, consider the original Fig. 1 and Table I. Under the weighted peak plan, the weighted peaks of Customers A, B and C are their peak demands of 10,000, 8,000 and 2,000 kw. For Customer D, however, since it occasions no demand on the peak and at the time of D's maximum demand the plant demand is only 9,000 kw.,

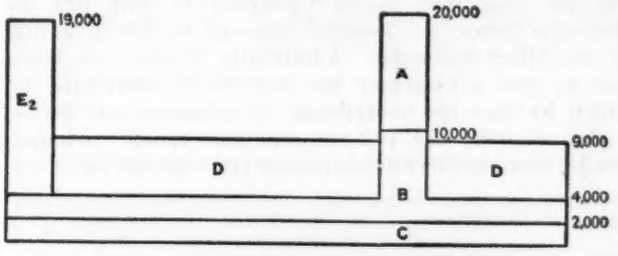


FIG. 3—EFFECT OF GROWTH OF BUSINESS OF AN EXISTING CUSTOMER

the weighted peak of D becomes zero plus nine-twentieths of 5,000, or 2,250 kw. Similarly, the share of E becomes fourteen-twentieths of 10,000, or 7,000 kw. The demand costs are thereupon allocated in proportion to each group's share of the total of 29,250, as shown in Table VI.

It will be noted that Customers A, B and C receive the same charge per kilowatt of individual demand. This is reasonable in that we are not justified in charging Customer C at a higher rate per kilowatt than either Customer A or B as long as we would just as soon have a new customer of the C type as one of the A or B type.

If and when a new peak arises, as shown in Fig. 3, there is no sudden shift of demand costs from one group to another, but the change is a gradual one as the second peak increases. For instance, with the growth of Customer E, as illustrated for the phantom method in Fig. 3 and Table II, we have the determination of demand costs under the weighted peak method as shown in Table VII.

Similarly, with the addition of Load G to Customer B, as illustrated for the phantom method in Fig. 4 and Table III, we have the demand costs of Table VIII.

With the addition of Load G to Customer C, we acquire a customer with a maximum demand off peak but with some peak demand—a type of customer unfortunately not considered in the article by Mr. Hills. The cost allocation under the weighted peak method is shown in Table IX.

TABLE VII—WEIGHTED PEAK. EFFECT OF ADDING 50 PER CENT TO CUSTOMER GROUP E

Based on Fig. 3 and Comparable with Table II.

	Weighted Peak	Kw.	Demand Costs—Total	Demand Costs—Per Kw.
A.....	Maximum demand.....	10,000	$27,400	$2.74
B.....	Maximum demand.....	8,000	22,000	2.75
C.....	Maximum demand.....	2,000	5,500	2.75
D.....	9/20 of 5,000.....	2,250	6,200	1.22
E-2.....	19/20 of 15,000.....	14,250	39,000	2.60
Total.....		36,500	$100,000	

TABLE VIII—WEIGHTED PEAK. EFFECT OF ADDING LOAD G TO GROUP B

Based on Fig. 4 and Comparable with Table III.

	Weighted Peak	Kw.	Demand Costs—Total	Demand Costs—Per Kw.
A.....	Maximum demand.....	10,000	$33,100	$3.31
BG.....	Maximum demand.....	8,000	26,400	3.31
C.....	Maximum demand.....	2,000	6,600	3.30
D.....	13/20 of 5,000.....	3,250	10,700	2.14
E.....	14/20 of 10,000.....	7,000	23,200	2.32
Total.....		30,250	$100,000	

Similarly, when Load G is added to customer group D, we have Table X.

The scheme as above suggested does not get rid of one of the defects of the methods used by Mr. Hills and Mr. Greene—namely, that the division of one group into two groups, or the combination of two groups into one, changes the cost allocation for the remaining customers. For instance, the combination of Customers B and E into one customer will affect the charges for the other customers under any of the schemes. The writer confesses failure as to getting away from this defect and it seems common to all methods except as to peak responsibility and kilowatt-hour allocation.

The point that will arouse the most strenuous objection on the part of some others is the allowance to the 100 per cent load factor Customer C, who has no diversity factor, the benefits obtained by the diversity of the other customer. Admittedly it does not seem fair to give a customer the benefits of something to which he does not contribute. If someone can devise a plan whereby the 100 per cent load factor customer can be charged his full share and yet whereby he is not

TABLE IX—WEIGHTED PEAK. EFFECT OF ADDING LOAD G TO CUSTOMER C

Based on Fig. 4 and comparable wfth Tabie IV.

	Weighted Peak	Kw.	Demand Costs—Total	Demand Costs—Per Kw.
A.....	Maximum demand.....	10,000	$30,400	$3.04
B.....	Maximum demand.....	8,000	24,400	3.05
CG.....	2,000 plus 13/20 of (6000 — 2000).....	4,600	14,000	2.33
D.....	13/20 of 5,000.....	3,250	9,900	1.98
E.....	14/20 of 10,000.....	7,000	21,300	2.13
Total.....		32,850	$100,000	

TABLE X—WEIGHTED PEAK. EFFECT OF ADDING LOAD G TO GROUP D

Based on Fig. 4 and Comparable with Table V.

	Weighted Peak	Kw.	Demand Costs—Amount	Demand Costs—Per Kw.
A.....	Maximum demand.....	10,000	$30,400	$3.04
B.....	Maximum demand.....	8,000	24,400	3.05
C.....	Maximum demand.....	2,000	6,100	3.05
DG.....	13/20 of 9,000.....	5,850	17,800	1.98
E.....	14/20 of 10,000.....	7,000	21,300	2.13
Total.....		32,850	$100,000	

charged any more per kilowatt of demand than his less desirable neighbors on the peak (A and B), it will be of great assistance to us calculators. Certainly Customer C is a more desirable customer than A in most cases. In addition there are other features of 100 per cent operation that should offset some disadvantage caused by crediting the 100 per cent customer with some of the benefits of the diversity factor brought about by the other customers.

Law of Competition Must Be Considered

Another thing that must be dealt with in rate making and the allocation of demand charges is the law of competition. The phantom scheme, as well as that advocated by Mr. Greene and Mr. Eisenmenger, does not follow this law, but gives all the benefits of diversity factor to the customers least able to produce their own energy. In the end such a policy, by restricting business, will hurt even those customers it at first apparently benefits.

The weighted peak method as previously outlined is not recommended as any hard and fast rule for allocating demand costs. It can be modified in many ways without any protest from the writer. For instance, still greater advantage can be offered to the off-peak customers by not considering any peaks of less than 50 per cent of the maximum plant peak and only charging a weighted peak for a sub-peak in proportion to its excess over 50 per cent of the plant peak. In such a case, considering Fig. 1 and Table I, Customer D would have no demand cost and Customer E would be allocated a weighted peak of four-tenths of 10,000, or 4,000, instead of fourteen-twentieths, or 7,000 kw. Another method might be the use of some curve whereby the relative importance of the secondary and tertiary peaks

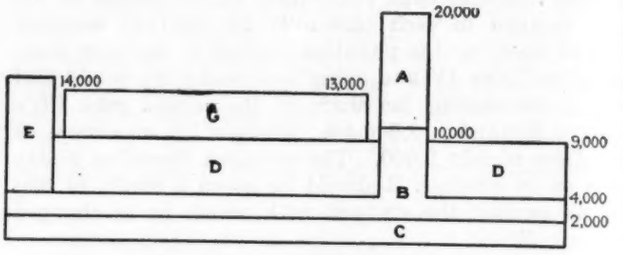


FIG. 4—EFFECT OF GROWTH OF BUSINESS

increased more rapidly as they approached the maximum peak.

All of the theories so far developed, including the weighted peak method, give odd results when changing conditions are considered. For instance, the merging of Customers B and E or Customers B and D will increase the costs chargeable to Customer A, regardless of whether the Greene, Hills or weighted peak method is used. Similarly, if we eliminate any one of the customers, we upset the cost of serving the others. If we did not have Customer D, the costs applicable to the other customers would be increased. Therefore anything that we charge to D over and above bare commodity costs and special expenses, regardless of smallness, is justifiable from the viewpoint of A and B in that it decreases their assessments. The more ways that each theory is tested out by applying it to different conditions the more one is tempted to believe that the time has come for the health authorities to step in and cart them all away, as in the case of our original subject, the calf.

What the Traffic Will Bear Principle

This brings us automatically to allocating costs according to what the traffic can most easily bear, even as the butcher of our illustration is compelled to use that theory.

The theory of allocating demand costs according to the summation of the various individual customers' demands follows the competitive theory to a certain extent, in that each customer is charged with a share of demand costs proportional to the size of the plant which would be necessary to serve that customer or group of customers by itself. The weighted peak method is an adaptation of the summation theory that introduces the time element. However, further to satisfy competitive requirements, the following proviso as regards the weighted peak method is warranted:

"The demands thus arrived at should be modified according to the local conditions of competition, with consideration for past history and future load possibilities as regards the various classes of customers."

The use of the qualifying clause may raise the question of possible discrimination against individual customers or group of customers and the following analogy is offered to cover this:

A printer is about to print a book. His "make-up" cost, including the writing of the book and the machine costs, is $1,000. The additional operating costs for paper and labor amount to 50 cents per book. His general overhead and advertising expenses and profit come to, say, $600.

Before going ahead with the job, the printer examines into his market conditions to find out how many books he can sell. He figures there is a market for a thousand books at from $2 to $2.50 each. There is another market for an additional thousand books at not more than $1 each. The printer therefore calculates the cost of producing 2,000 books as follows:

Make-up cost	$1,000
2,000 books at 50 cents	1,000
Overhead and profit	600
Total	$2,600

Cost per book, $1.30

Upon arriving at this unit figure of $1.30, the printer, of course, discovers that one-half of his market is closed to him if he is going to maintain a uniform price. He therefore figures the cost of making only 1,000 books as follows:

Make-up cost	$1,000
1,000 books at 50 cents	500
Overhead, etc.	600
Total	$2,100

Cost per book, $2.10

However, suppose the printer decided to discriminate and sell at different prices to the two different groups of customers. If he sells a thousand books at 90 cents and the other thousand at $1.70, he will receive a total of $900 plus $1,700, or $2,600, which is equal to his total cost and desired profit.

Now, if the cost accountant were asked to check these figures, he would probably divide the $1,000 of make-up cost by the 2,000 books, giving a cost of 50 cents per book. Upon adding to this the 50 cents operating costs, he would get $1, or 10 cents more than the selling price to the one group of customers. Presumably he would thereupon call attention to the apparent discrimination existing in selling books at less than their bare operating costs, excluding general and advertising expenses and profit.

Possibly it is discriminatory, but if the figures are examined it will be noted that the cost to the customers paying the higher price is less under the discriminatory method than if no books were sold at the low price. By reason of the discrimination, the maximum book price is $1.70 instead of $2.10. This we may class as equitable discrimination in that the parties discriminated against are benefited instead of being hurt. The law forbids only unjust discrimination.

Someone more familiar with the printing business might pick to pieces the figures used in the foregoing illustration, but the principle will remain unchanged; in fact, some such principle must be in actual use, for the same book which sells at one counter for $2 can often be purchased at another one for 75 cents.

Similarly, in the public utility business, we are justified in allocating costs according to what the traffic can most easily bear and in offering differential rates for different classes of business based upon such allocations. We have no right to say any class of business is not paying its fair share of the costs so long as the acquisition of that business did not increase the cost to be borne by the remaining customers.

Since the foregoing was submitted to the ELECTRICAL WORLD another article on cost allocation by W. J. Greene has appeared (July 23), in which the "phantom customer method" is described by Mr. Greene as apparently only the ghost of a former method devised by himself in collaboration with Messrs. Schoonmaker and Gorton. Mr. Greene expresses himself as confident that no convincing argument can be raised against his contentions and those of Mr. Hills as to the allocation of capacity costs. The writer is therefore forced to refer Mr. Greene as well as Mr. Hills to the arguments contained in the foregoing.

Progress with the Grid System in Britain

HIGHLY satisfactory progress is being made in the preparation of the various schemes of the British Electricity Commissioners under the electricity (supply) act of 1926 in connection with what has been called the new "grid" system, which involves a linking up of specially selected stations throughout the country.

The Scottish scheme, which was the first undertaken, has been approved by the central board, and the work of linking the selected stations and standardizing frequencies will be pressed forward without delay. This scheme deals with a large district in central Scotland, 4,980 square miles in area, including Edinburgh, Glasgow, the Clyde district and Ayrshire. The schemes affecting England are expected to be issued soon, the first being one in relation to central England, an area which presents a wide diversity of conditions. The electricity board has authority to borrow money up to £33,500,000 ($167,500,000) for carrying out the proposed plan.

The chief purpose of the national scheme is to effect economies by connecting the most efficient stations, a result that should be helpful to large industrial areas. Uneconomic production will be eliminated and facilities provided for cheaper electricity in areas where it is not at present available. The board will purchase all the electricity developed at the selected stations and sell to the authorized utilities, which will distribute it to the power users. In the case of the Scottish plan it is estimated that ten years will be required before it is put into complete operation.

Electric Motor Replaces Old Beam Engine

THE replacement of one of the oldest beam engines in Lancashire, England, by an electric motor was effected recently in one of the cotton mills. The old engine, built in 1850, developed 350 hp. and drove 1,564 looms. The motor which has just been placed in operation develops 350 hp. and drives 941 looms. Current is delivered by duplicate cables at 10,000 volts and reduced to 400 volts for utilization. The old engine occupied a space 60 ft. x 32 ft. x 48 ft.; the new motor occupies 10 ft. 6 in. x 8 ft. x 5 ft. 6 in.

Protection from Lightning—II*

Application of Theory and Experimental Data to Transmission Lines—Lines Immune from Lightning Must Be Built on Economic Basis—Field and Laboratory Data Check

By F. W. Peek, Jr.

Consulting Engineer General Electric Company

FROM the fundamental conceptions of lightning presented in the previous article, from simultaneous measurements with needle and sphere gaps, from the effect of insulator flashovers and from more recent tests with the klydonograph it seems quite certain that most lightning impulses that appear on lines are non-oscillatory, or very highly damped. They may be of steep wave front and of a duration ranging from a microsecond to a number of microseconds. A recent study of insulator flashovers due to actual lightning shows that many of the very high-voltage ones were caused by waves of steep front and had a duration of several microseconds. If the lightning voltages that appear on any line during a given year are plotted with gradient or voltage divided by height of conductor, a curve similar to that shown in Fig. 2 is obtained. The majority of the induced voltages are (+), though some are (—). A (+) induced voltage indicates a (—) cloud. The highest voltages and apparently all or nearly all of the direct strokes are (—), indicating a (—) cloud.

The sudden increase in the (—) is probably due to direct hits. Over this range of voltage the maximum apparent gradient is not reached, because of insulator flashovers. The insulator flashover limits the voltage and is thus the maximum voltage to which the apparatus can be subjected unless the tower footings have considerable resistance. When tower footings have high resistance, flashovers may occur on several successive towers. The flashover results in an oscillation which is generally so highly damped that its effects are the same as an impulse. The current is determined by the voltage and the surge impedance and is about 2 amp. per kilovolt.

The Voltage of Lightning on Transmission Lines

The maximum induced voltage that can appear on a transmission line is independent of the line voltage and is determined largely by the height of the conductor. Thus $V = g_a h = Gh$. If the line is located immediately under the storm center and the discharge takes place very rapidly, the maximum value of G is 100 kv. per foot. Generally this condition will exist only in the case of direct strokes and the maximum apparent gradients for very severe storms will be of the order of 50 kv. per foot, while for the majority of storms the gradients will be much lower than this. This follows because of the rapid decrease in gradient as the storm center moves away from the line and also because many discharges occur at a comparatively slow rate and many clouds are comparatively small. The charge has thus time to extend over a larger portion of line while the cloud is discharging.

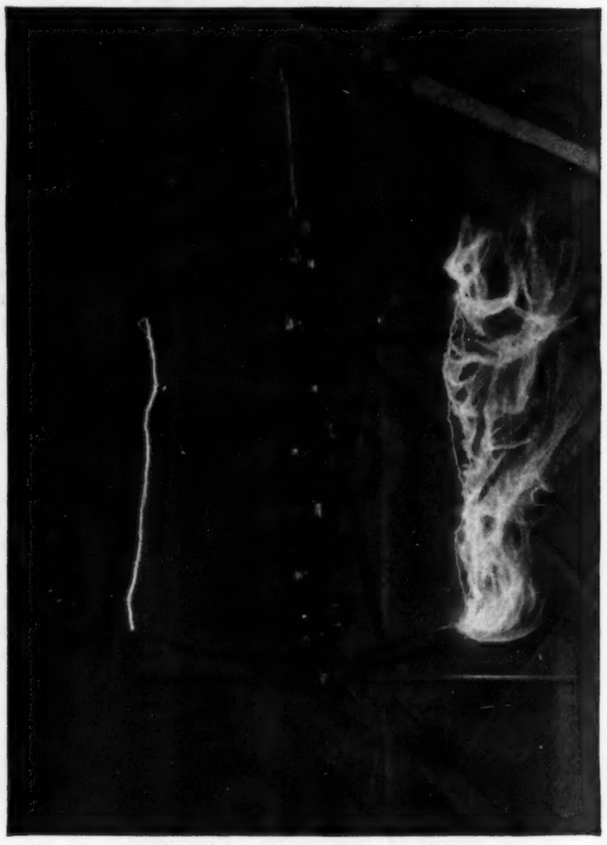


FIG. 1—SIXTY-CYCLE SPARK-OVER ON AN INSULATOR STRING SHIELDED WITH THE GRADING SHIELD

The variation in voltage with height of conductor for rapid discharges is given in the accompanying table. The voltages were found by multiplying the height of tower by the gradient caused by the cloud. In the second column the maximum voltage was found by using a gradient of 100 kv. per foot. As previously stated, this is the gradient necessary to cause the lightning flash, and it can only apply to the line when it is directly under the storm center. The voltages in the third column were found by using an apparent gradient of 50 kv. per foot. Such a gradient occurs when the line is about 1,000 ft. from the projection of the storm center. It is a severe condition and does not usually

*Article presented at the International High Tension Conference, Paris, July, 1927. The first part was printed in the issue of Aug. 20, 1927.

occur. In column 4 a gradient of 100 kv. per foot was used, while a gradient of 50 kv. per foot was used in columns 5 and 6. All these conditions are severe and unusual. The voltages are those corresponding to the instant when the flash occurs and before possible insulator arc-overs can take place.

When the conductors of a transmission line are arranged in a horizontal plane, there should be no lightning voltage between them, since they are all the same distance above ground. However, this is not the usual condition. For example, with a 220-kv. line with conductors in a vertical plane, the voltage between the adjacent conductors depends upon their relative distances above ground. This voltage may be of the order of one-third of the voltage to ground.

An examination of the table shows that a high tower is undesirable from the lightning standpoint. This applies to either induced voltages or direct strokes. With conductors at a height of 40 ft., lightning voltages could readily flashover a fourteen-unit insulator string. With a ground wire the probability of flashover would be almost eliminated. This would not be so if half the number of insulators were used. This emphasizes the fact that the effect of a ground wire on insulator flashovers is more decided on high-voltage lines than on low-voltage lines.

Some data obtained in practice on one 66-kv. system having more than a thousand miles of line, half with and half without ground wires, show about five times the insulator arc-over per mile on the unprotected lines. The data on higher-voltage lines give ratios of from ten to one to twenty to one in favor of the ground wire. However, these data do not yet cover a sufficient period of time to fix these ratios definitely.

Practical Application of Principles

Whether or not a line is immune from lightning failure or outages is determined not by the operating voltage but by the tower height compared with the clearances to the tower and distance over the insulator string. Immunity, therefore, rests largely with the tower designer. The ground wire, by reducing voltages, has the effect of increasing clearances and adding insulators. The grading shield, which is now used extensively, has important functions, and while it generally increases the lightning arc-over voltage, it cannot take the place of insulator length or tower clearance in preventing arc-overs. No shielding device can.

A practical example may be of interest. Assume a line with conductors in a vertical plane averaging 40, 50 and 60 ft. above ground hung by ten-unit insulator strings. With a gradient of 30,000 volts per foot the lightning voltages would be respectively 1,200,000, 1,500,000 and 1,800,000 above ground on the bottom, center and top lines. Since a ten-unit insulator string has a lightning arc-over voltage of about 1,400,000, trouble would be expected on the top and middle strings. A shielded insulator string of fouteen units and equivalent tower clearances would not arc-over under the above conditions. With a gound wire, the above voltages would be reduced, and much severer storms would be necessary to cause trouble. The ground wire is equally effective in reducing stress on apparatus.

Because it may not be economical to make many lines absolutely lightning proof, it becomes important to take care of infrequent troubles with the least possible disturbances. This can be done by providing a grading and arcing ring and quick sectionalizing relays. The grading ring makes operating or lightning voltages divide evenly over the string, prevents concentration of voltage on the line unit, causes greater voltage stability, prevents corona at operating voltage and makes any occasional arc-over clear the string, thereby reducing the probability of damage to the string and conductors. The top and bottom insulators of a non-shielded string are usually most subject to damage; the top unit is damaged from the heat of arcs and the bottom unit from excessive voltage. The grading shield corrects both of these undesirable features. A horn set to clear a 60-cycle arc will not clear a lightning arc unless it is set so as to reduce very greatly the arc-over voltage. The grading effect of the ring increases the suface strength to lightning and causes the arc to clear the string without voltage reduction.

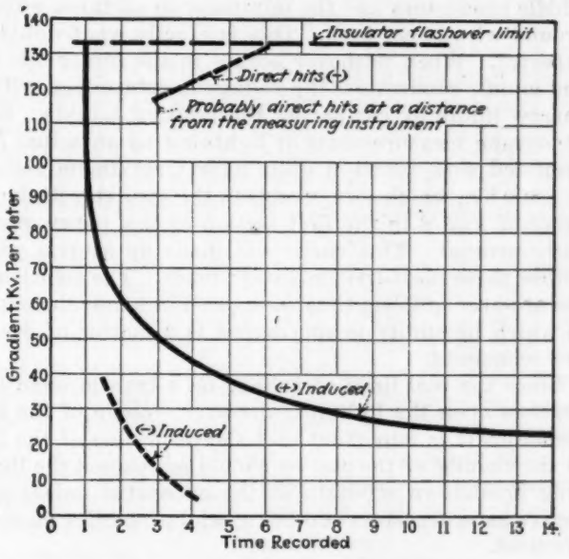


FIG. 2—LIGHTNING GRADIENTS MEASURED ON TRANSMISSION LINES. COMPOSITE CURVE TAKEN FROM DATA ON A NUMBER OF LINES

In the above example there would be 600,000 volts

LIGHTNING VOLTAGES ON TRANSMISSION LINES*(KILOVOLTS MAXIMUM)

Height of Conductor, Ft.	No Ground Wire: Theoretical Highest	No Ground Wire: Probably Usual Highest	Ground Wire: Direct Stroke to Ground Wire (One Wire)	Ground Wire: Usual Highest (One Ground Wire)	Ground Wire: Usual Highest (Three Ground Wires)	Lightning Flashover Voltage of Line Insulator: 220-Kv. Line 14 Units	154-Kv. Line 10 Units	110-Kv. Line 7 Units
75	7,500	3,750	3,750	1,875	900	....	....	....
50	5,000	2,500	2,500	1,250	625	1,800	....	....
40	4,000	2,000	2,000	1,000	500	1,800	1,400	1,000
30	3,000	1,500	1,500	750	375	1,800	1,400	1,000
20	2,000	1,000	1,000	500	250	....	....	....

*The voltage values given assume no insulator flashover. Actually, the highest value of voltage which takes place at the tower is limited by the magnitude of the insulator flashover voltage.

For a neutral grounded line the voltage above ground just before the discharge would be zero. For an isolated system the line would not assume the above voltage before the discharge, as there would be leakage over insulators and arresters and much static. There would also be a reduction of the static voltage by the section of the line not under the cloud.

between top and bottom conductors. If the conductors were arranged in a horizontal plane, the voltage above ground for the storm considered would be 30 × 40,000 or 12.2 × 9,000 = 1,200,000 on all the conductors. There would be no voltage between the lines. Operating information concerning the arc-over voltage of insulator strings of different lengths in the different parts of the tower is of use in determining the usual and maximum gradients to be used in estimating the lightning voltages for different localities. The data at present available from the field check the laboratory and theoretical research work very well. On one system without a ground wire apparent gradients of 20,000 to 30,000 volts per foot occurred about ten times during a season. These values were determined by the known lightning arc-over voltages of the insulator strings and the distances of the lines above ground. The data obtained from a number of systems show by far the largest number of arc-overs on the top conductor, the second largest on the top and middle conductors and the minimum on all three when a ground wire is not used. This is exactly what would be expected. When flashover occurs in the top or the top and middle conductors, the voltage is determined within narrow limits by comparing the relative heights. Klydonograph measurements of lightning on an actual line insulated with fourteen units gave a maximum voltage of 1,800 kv., which corresponds to the insulator flashover curve of Fig. 8 in the first section of this paper, previously printed. This curve was made up several years before these measurements were made. The solution of the arc-over problem thus seems well in hand; the extent to which immunity is approached is a matter of design and economics.

Since the real limit of voltage on a transmission line depends upon the lightning arc-over voltage of the line insulator, it is important that the insulation of the line in the vicinity of the station should not exceed the lightning breakdown strength of the apparatus unless protective gaps, arresters or other special protective methods are used.

A system of insulation with a normal number of insulator units near the station and an excess out on the line seems quite rational.

Location of Stations

A study of insulator flashovers on transmission lines shows that the severe lightning effects generally occur at localized points along the line. If stations are located at these points, trouble is likely to occur on the apparatus. It is frequently necessary to use high towers at some local point, as for instance at a river crossing. Such towers invite direct hits and cause high induced voltages. Fortunately the maximum values can rarely be attained, because the spans are usually short enough for α to be small. However, it is well to take every precaution when such an arrangement is near a station. Outages due to insulator arc-overs are the main source of trouble.

Oscillations of internal origin, due to switching, arcing grounds in grounded neutral systems, etc., very seldom reach voltage values sufficiently high to cause apparatus breakdown, and usually need not be considered in the protective problem.

Insulator flashovers may be caused by overvoltages due to lightning or to a reduction of insulation and flashover at operating voltage due to dirt. Outages due to dirt are very rare except in localities having a long, dry season followed by a wet one. Sometimes special dirt troubles occur. Birds, for instance, have been a serious cause of trouble on the Pacific Coast, making it necessary to use bird guards in many cases.

Lightning Arresters and Their Use

The object of a lightning arrester is to divert or sidetrack the traveling wave from the line before it reaches the apparatus. A sphere-gap set to arc at a voltage lower than the breakdown voltage of the apparatus is

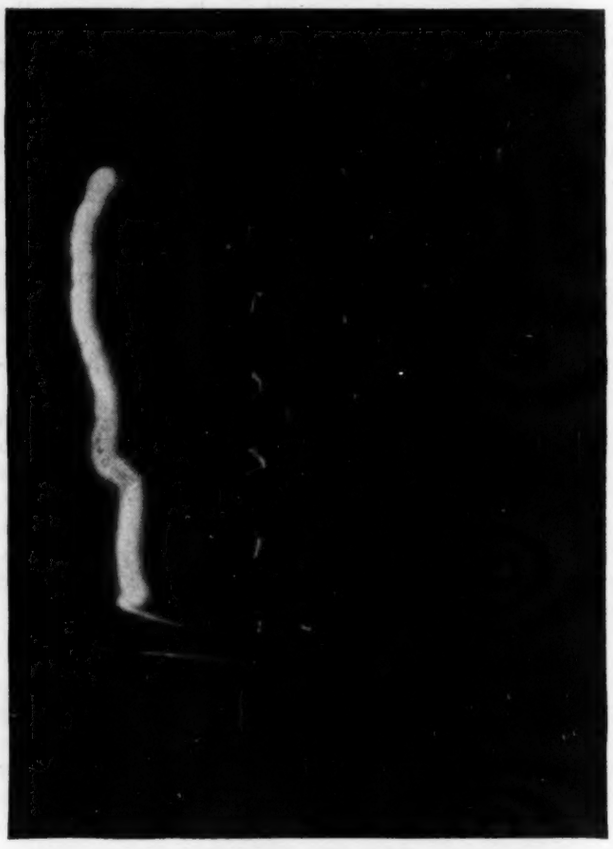


FIG. 3—LIGHTNING SPARKOVER ON AN INSULATOR STRING SHIELDED WITH THE GRADING SHIELD

quite effective from the standpoint of lightning protection, but a service interruption follows every discharge. In practical arresters a device has been added in series with the gap to prevent the dynamic from following the lightning discharge. In general, since such devices tend to reduce the protective value of the gap, the practical design must be a compromise among the various factors. The arc-interrupting device should preferably have the characteristics of a safety valve. In addition to having a low impulse ratio, it is desirable that the arrester chop the wave off quickly, since the strength of insulation depends on duration as well as maximum voltage. An arrester with high resistance is generally not effective, because the high lightning currents do not permit it to reduce the voltage sufficiently. An arrester cannot be used to prevent insulator arc-overs and outages on the line, since it is effective only at the point at which it is located. Its chief duty, therefore, is to protect apparatus by reducing excess voltages sufficiently to prevent failure or deterioration.

The principles already discussed can be applied to the protection of buildings, oil tanks, magazines, etc. Oil, for instance, is frequently stored in very large quantities. This storage is often so large, in fact, that metal tanks are not economically feasible. The tanks or reservoirs, which are usually made of reinforced concrete, are frequently 500 ft. in diameter, but sometimes in oval form as large as 600x1,200 ft. and 30 ft. deep. Occasionally some of the smaller tanks are of metal. The capacity ranges from 700,000 to 3,000,000 bbl. A group of tanks makes up a farm.

The tops of the tanks are covered with wood or wood covered with felt or other materials to keep out the sun and prevent evaporation. Between the roof and the surface of the oil there is an air space which may contain a mixture of oil vapors. This mixture of air and oil gases may be in the right proportions to be explosive and capable of being ignited by a very small spark. Sparks can occur between metal parts on the roof or between wet parts by induction or by direct strokes and cause fires or explosions. It is probable that induced voltages can cause fires only when inflammable or explosive gases are present. Direct strokes can set oil or wood on fire.

Various principles found in the general study of lightning, as well as specific investigations for transmission lines, etc., can be applied to oil tank and reservoir protection. Some additional work done specifically on model oil tanks will be given. While work on models and theoretical work cannot always exactly simulate or anticipate all practical conditions, it should be of great help in solving the problems of protection.

How Sparks Occur in Oil Tanks

Sparks can occur in oil tanks or magazine by a direct stroke, by electrostatic induction or by electromagnetic induction. A direct stroke can take place when the storm center is over the oil tank and can set fire to wooden roofs, ignite oil directly or indirectly or melt metal plates. Sparks can form between conducting parts by electrostatic induction, from storms overhead or from storms at a considerable distance. As already noted, induced sparks can generally cause fires only by ignition of gases. Electromagnetic induction could cause sparks as a result of heavy currents caused by a direct stroke in the vicinity of the tank.

Direct strokes are by far the most dangerous, but voltages by direct strokes are much less likely to occur than by induction. Induced sparks can occur only between isolated conducting parts or conducting parts in poor contact. These conducting parts could be of metal or water, etc. Trouble by electromagnetic induction is probably the least likely to occur.

Tests on models have shown that induced voltages can produce tiny sparks inside of cages even when the mesh is comparatively small. No sparks can be obtained inside complete metal tanks. Sparks can occur in metal tanks, however, between plates making poor electrical contact or pipes brought in from the outside and not making good contact with the tank.

Sparks may occur between puddles on roofs or on roofs made of partly conducting material, which are dangerous.

While the most severe lightning effects are produced by direct strokes, it is necessary, in order to have a direct stroke at a given spot, for the cloud to be over that spot at the instant it is charged to sufficient voltage to cause a discharge.

Voltages by direct strokes are thus much less likely to occur than voltages by induction, since induced voltages can be produced by any storm within a radius of several miles. Sparks by induced voltages cannot occur unless there are conducting parts almost in contact or making poor contact, such as wire, nails or wet spots on a wooden roof, etc. Although the chances of direct strokes are usually small, the effects are so severe that an exhaustive study of protection against them seemed worth while. The general methods followed were similar to those used in previous work. Models were built to scale and subjected to voltage from the lightning generator as well as all other types of voltages. The same general results were obtained from all types of clouds, points, spheres and planes. The hits were recorded by placing paper targets under the tank or other object under study. A hole in the paper recorded the spot struck. There was an area immediately around a rod that was not struck. It can be seen that a model building or tank properly located with reference to a rod would not be struck.

It has been found that this same principle applies to a number of rods. For instance, if four rods are arranged at equidistant points around a circle in such a way that their protective areas overlap, a spark never strikes inside the circle. Thus a building or tank placed within the circle would be protected from direct hits. It is desirable to place the rods at a distance equal to the length of the rod away from the tank.

Other methods of protection have been investigated. An umbrella frame of conductors placed over the tank can be made to take direct hits. Parallel wires strung over the tank would prevent direct hits to the tank provided the wires were not separated more than four times their height above the tank. Other types of meshes or cages could be used. The disadvantage of such arrangements is that it is generally not practicable to place the conductors high enough above the tank to prevent side flashes to the roof. The lightning flash is also brought directly over the tank with the possibility of dropping of hot metal, or causing magnetic induction, etc.

Practical Protection Is the All-Metal Tank

From the investigation, it seems that an all-metal tank offers the only complete protection in oil storage against both direct strokes and induced lightning voltages. The thickness of the metal is not important from the standpoint of induction, but from the standpoint of direct strokes it must be great enough to prevent melting through. The cover and all other metal parts must be in good electrical contact. This especially applies to adjoining parts near together.

When explosive or inflammable gases can be eliminated, the problem is greatly simplified, since it is reduced to the protection of the tank against direct hits. It appears that this can be done by placing pointed rods around the tank. A round tank can be protected by three rods. No part of the protected area must be at a greater distance from some rod than approximately four times the height of the rod. It will usually be advisable to use a ratio less than four. To be conservative, a factor of safety should be added to the ratios given in this case.

It is desirable to locate the rods about a rod length away from the tank, although it is possible that this distance may be as small as half a rod length without trouble. The object of placing the rods in this way is to

cause the hits to occur at some distance from the tank and to prevent side flashes. The rods should be arranged so that every direction of approach is covered and they should be grounded to damp earth immediately below. Where the ground resistance is high or uncertain, it is probably best to connect the rod to the tank ground as well as to its own ground. If guys are used, it is desirable to make them as short as practicable and to attach them to the rod as near the ground as practicable. When there are projections above ground, the height of the rods should be increased an amount equal to that of the highest projections.

When inflammable gases are present, it is important to reduce or eliminate induced voltages. This can be done by means of a thin metal or conducting roof grounded and perferably extending over the sides. A less degree of protection can be obtained by nets or wires placed on the roof in the same way. When nets are used, the closer the mesh the greater the protection. Less protection would be given by wires or nets in practice than is indicated by tests on models. This follows because the inductance of long wires would not permit them to go instantly to zero potential.

The high degree of protection given by an all-metal tank is probably more nearly approached by a combination of rods to take direct hits and a thin metal or conducting roof and sides to protect against induced voltages. Wire or mesh on or above the roof instead of metal sheets would reduce induced voltages to a less extent. The above methods were discussed in detail as an example, because they seemed among the most practicable. Models of large groups of tanks have been set up and tested. Thus in the protection of oil tanks cost is the determining element.

Merchandising Through the Dealer

Practices of the Valley Electrical Supply Company Outlined—Use of Special Appliance Sales Campaigns—Dealer Aids Listed

THE Valley Electrical Supply Company is operated as a separate merchandising corporation, but as a subsidiary to the San Joaquin Light & Power Corporation. It does its own financing and purchasing and operates on a strictly merchandising basis, paying for its rent and light in the power company's building, as would any merchant in the city who occupied corresponding space. This company has had remarkable success with a merchandising plan that has been in operation for several years and that was announced fully at the convention of the Electragists International in St. Louis Aug. 10.

Sales Policy

The method of merchandising ranges is to make all sales through the retail outlets that are located on the system of the power company. The salesmen of the Valley Electrical Supply Company assist the dealer in making sales on ranges, water heaters and heavy-duty appliances, or will make the sales and place them through the dealer. All the sales are placed with the dealer or dealers within the immediate territory in which the equipment is sold. This service is given the retail outlet that co-operates with the San Joaquin Light & Power Corporation and the Valley Electrical Supply Company in putting over the range, water heater and heavy-duty appliance campaign.

When sales are made by the Valley company salesmen, the salesmen must inform the purchaser of the nearest retail outlet that is co-operating in the campaign, and the purchaser then selects the dealer or merchant with whom he wishes to place his order. Should the purchaser wish the Valley company salesman to place the order with some responsible dealer or merchant, it is the duty of the salesman to use his best judgment and select the dealer. Should there be two or more dealers in the immediate vicinity, the order would be placed with the firm that is most entitled to the sale.

Each Valley company salesman is responsible for all sales of this equipment in his territory, whether he makes the sale or not. These salesmen take no commission, bonuses or gifts from dealers or merchants for helping them in making sales or placing sales. This is a continual campaign on sales of this equipment, with salesmen working on a definite weekly quota basis throughout the entire year. By this method of range sales it is seen that all sales are placed through the retail outlets, which carry the credit risk with the consumers.

Two Model Stores Used

In merchandising small appliances the Valley company maintains two retail appliance stores, one at Fresno and one at Bakersfield, the two large cities on the system. From these stores appliances are advertised, demonstrated and sold directly to the consumer and are also sold through the retail outlets. These two stores are maintained as models to serve as examples in electrical appliance merchandising to all electrical appliance outlets on the system. At five different times during the year the Valley company uses special appliance sales and purchases a large quantity of appliances from some reputable appliance manufacturer who does not carry a nationally advertised list price.

The retail outlets in the territory value this campaign element and are brought into the picture very closely. Fifteen days prior to the start of one of these appliance special sales one of the Valley company's salesmen calls on every retail outlet in the territory served, offering each one an opportunity to tie in with the special sale. Each dealer willing to co-operate is asked how many of the special appliances he believes he could

dispose of, and is urged to estimate the number conservatively. The salesman thereupon leaves with the dealer the required number of appliances, receiving in exchange a check. The appliance is sold to the dealer at practically its cost to the Valley company. Each dealer is urged to display the special appliance prominently and to use every call for the special as an opportunity to sell the standard lines of these appliances rather than the special. The argument used is that this would net him 40 per cent on each sale instead of 30 per cent.

On the morning after the close of each campaign the salesman calls to take back the advertised special appliances if any is left, refunding money on each appliance not sold. In this way the dealers are obliged to close the special sale simultaneously in every part of the territory. In each campaign, broadsides and newspaper advertisements are used, carrying the names of the individual merchants that are co-operating in the district.

Charges to the Power Company

The charge to the San Joaquin Light & Power Corporation for selling heating and cooking equipment is $5.08 per connected kilowatt. This sum is paid to the Valley Electrical Supply Company on all items of domestic and commercial cooking, baking and water-heating equipment sold throughout the power company's territory, regardless of whether the sales were effected by the Valley company's salesmen or through outside agencies. Domestic air-heating equipment only is credited to the Valley company if the appliances are sold by its own salesmen. In no case does the Valley company receive credit for the sale of commercial or industrial air-heating equipment, commercial bake ovens and sterilizers. The range sales cost includes the cost of demonstrating ranges in the home, cooking schools, cooking demonstrations in dealers' stores and free demonstrations at all fairs on the system, as well as continual calls to check up on ranges. About 95 per cent of the ranges are sold to rural customers. This charge of $5.08 per connected kilowatt is about one-third of the first year's estimated annual revenue. The charge to the power company for the sale of lamp socket appliances by the Valley company is $3.66 per connected kilowatt. This sum is paid on all lamp sockets and convenience outlet appliances sold through the Valley company's efforts. This charge is figured at about one-third of the first year's revenue. The cost to the power company of the sale of ranges and appliances on the basis of the revenue derived from five years of operation of the plan is 6.35 per cent.

The Use of Quota System

The quota method is used very effectively in the campaign with the 55,000 domestic customers on the system. The quota for 1926, for example, was 1,000 ranges, 800 water heaters, 300 heavy-duty appliances and 500 large air heaters, which represented a connected load of 10,800 kw., or about $220,000. Through the co-operative efforts of the power company, the Valley company, the manufacturers and jobbers and the retail outlets, a total of 11,498 connected kilowatts was sold, which was equivalent to $235,000. The quota in lamp socket or convenience outlet appliances in 1926 was $780,000. Of this amount $106,000 was sold in a special campaign on appliances. The total actual sales for 1926 was $960,000. For 1927 the sales quota on these appliances is $1,240,000.

In choosing appliances to be campaigned there are eight points that are watched very carefully:

1. Do not campaign or cut the price on a nationally advertised list price appliance.
2. Accent the service the appliance will render.
3. Choose appliances manufactured by reputable manufacturers that are expected to continue in business.
4. Accent the exceptional value feature of the sale.
5. Sell the appliance at a price that will net the electrical outlet a profit of 30 per cent on the selling price.
6. Sell the appliance on the basis of so much down and so much a month.
7. Make the price of the appliance right—in other words, within the reach of the greatest majority of the prospects.
8. Do not purchase too many appliances, for the purpose of selling the special is to get them out early in order that the outlet may sell more nationally advertised list price appliances purchased through his jobber.

Dealer Requirements

In order that an electrical outlet on the system may tie in on one of the merchandising campaigns it is necessary that the outlet sell these appliances on a definite sales policy, which is that it will sell at the same price and terms as specified in the advertising of the Valley company. It is also the policy that this appliance shall be given a prominent display space and used as a stimulator for other appliance sales. These appliances are generally purchased directly from the manufacturer, with perhaps the jobber receiving 5 per cent on the sale. It is believed that no merchandising campaign can be successful unless all four branches of the industry are taken in on the campaign.

Twelve reasons are given why the local dealers should tie in with the power company's merchandising department in making campaigns a success:

The first of these reasons is that advertising pays for itself by the time it saves in making sales. Of the total time required by a salesman to make a sale by personal solicitation, experience shows that one-third of the time of the sale is saved if the article is nationally advertised. Another third of the time is saved through local advertising, leaving only one-third of the total time actually to make the sale.

The second reason is that it is profitable to the dealer. Should a dealer sell twenty percolators at $5.95 each, these percolators costing him $4.20 each, the net profit would be $33. Should all the twenty percolators be sold at $1.95 down, the investment of the dealer would be $47 for 30 days. The first payment at the end of 30 days of $2 on each percolator would return him $40, or at the end of 30 days the dealer would have an investment of $7. A second monthly payment of $2 pays up the balance on each percolator, thus showing a gross profit of $33 for the dealer on the sale of the twenty percolators.

A third reason is that it makes for appliance sales opportunities in other lines.

A fourth reason is low operating cost figures based on the kilowatt-hours used in consumption.

A fifth reason is that the purchases of the average American family show the budgeted expenditure for electrical appliances per home per year is very low.

The sixth reason is that it accents the pride of ownership appeal.

The seventh reason is the higher living standards that now exist.

The eighth reason is the installment-buying plan and its sales-getting possibilities.

The ninth reason is that installment buying has not affected savings seriously.

The tenth reason has to do with buying habits, showing the little that is spent for electrical appliances.

The eleventh reason is that it accents quick turnover. The co-operative appliance sales show twelve turnovers a year on campaign appliances.

The last reason is the sales help that is given selling outlets.

Letters from Our Readers

Public Utility Policies Questioned

To the Editor of the ELECTRICAL WORLD:

As an engineer who is not and has not been connected with any public utility, and who has not had practical experience in solving the many problems of policy that must beset them, I have become convinced that in some respects they are by no means so progressive as they claim to be. Such a statement is open to the criticism that it is based on incomplete knowledge, but it may be worth consideration, since too frequently progress in the service of the public comes from outsiders rather than from those who are so close to the details of their daily work that they have lost the ability to question the correctness of the policies which they are following daily.

Recently I was asked to discuss in a series of editorials for a suburban paper the problem of placing underground the wires of public utilities. Being an engineer, I sought to handle the subject in an authoritative manner and impartially. In connection therewith I wrote to the president of one large electric lighting company asking a series of questions as to cost, maintenance, depreciation, et cetera. Not receiving an answer, I wrote again, but worded my letter in such a way that failure to answer it would be very embarrassing. Then I was assured that the questions I asked were too complicated to discuss. Needless to say, I got the information I wanted by going to representatives of public service commissions, manufacturers and contractors.

In the course of my investigation I was assured by a number of salesmen for various manufacturers of wire and cable that the public utilities frowned on any endeavor to promote the sale of cable for underground construction by extensive advertising to the general public or by direct approach to the authorities of various communities. One salesman assured me that if he were to address the residents of any community in order to advocate underground construction for wires he would lose his position very quickly. This censorship or control is exercised through the leverage exerted by the public utilities by reason of the much larger purchases of wire for overhead construction as compared with cable for underground construction.

As my investigation continued from one interview to another, I found that the problem of adequate and efficient street lighting was mixed up with it. Here also I learned that for similar reasons the representatives of the manufacturers selling street-lighting fixtures did not dare make a proposal for improved street lighting to the officials of a community until they had consulted with the proper officers of the local electric lighting company.

Yet the fact remains that in many communities the trees have been badly mutilated by the utilities in order to make room for the various overhead wires. Many streets are ugly in appearance through the multiplicity of poles and wires. Inadequate and poor street lighting is too often the rule. In many of our suburban communities considerable pride is taken in the appearance of homes and grounds. The best that architects have to offer in the design of houses and landscape has been drawn upon freely. Yet in just those very communities we shall find that the public utilities have shown little progress in getting wires underground or in improving the street lighting. The utilities by refusing to let the communities learn from the aggressive advertising and salesmanship of manufacturers of the possibilities that exist in better street lighting and the placing of wires underground have erected a barricade of ignorance against progress. The reason for their attitude is easily understood, but it may be based on false premises. Certainly it is holding America back from becoming a better and more beautiful place in which to live.

Suppose the insurance companies had been prohibited from advertising direct to the public the sale of their life insurance policies. Suppose that the manufacturers of automobiles and their accessories had to get the permission of a third party before they approached a prospective purchaser. We may be sure that if this had been necessary during the last few years America would not be leading the world in the amount of insurance and automobiles sold. The present high standard of living would not be possible.

We could point to numerous other fields wherein progress has come through lack of any censorship. Therefore, I am convinced that it is high time manufacturers of cable for underground construction and of street-lighting fixtures received complete freedom of action in the promotion of the sale of their products. They should be allowed to advertise in any manner they see fit, using the very best skill available in the presentation of their story of the advantages of underground construction for wires and of improved street lighting, for the improvement of the esthetic appearance of a community. Their salesmen should be permitted to approach directly the officials of a community without the necessity of consulting the executives of the local lighting company.

Of course, there will be differences of opinion developed for which only the solution of facts clearly presented is possible. Out of the exchange of opinion that will result progress will come. Progress is necessary, for the present censorship is hurting America. The growth of manufacturers affected is slowed up. Production is curtailed and profits that might be earned are not taken. Most important of all, we are not moving forward as rapidly as we might to the end that America shall be a better and more beautiful place in which to live. If we are not doing that, then all this talk by the public utilities about better and better service for the public is so much nonsense.

GREGORY M. DEXTER

New York City, N. Y.

Central Station and Industrial Practice

Trouble Department Organization

By L. A. Southard

Superintendent of Electrical Distribution, Jackson District, Consumers Power Company, Jackson, Mich.

THE large area served by the Consumers Power Company in the State of Michigan makes impracticable the functioning of any central trouble organization for the whole system and therefore the Michigan system is divided into fifteen districts, each district centering around the largest city or town in that section of the territory.

In the case of the Jackson district, to which the trouble organizations of other districts are similar, the trouble crew consists of four men with their shifts so arranged that two men are on duty from 7 a.m. to 10 p.m., and one man from 10 p.m. to 7 a.m. These men replace transformer and house fuses, look after street-lighting maintenance and respond to fire department calls. They are all experienced linemen and are capable of handling hot lines up to 13,200 volts. Under normal conditions the trouble men cover the city and the territory around it to about a 30-mile radius. In addition to the regular trouble men, there are men on call in the larger towns and villages of the district, and in cases of bad storms or widely spread system trouble every lineman in the company is subject to call.

Trouble calls are received directly at the service building where the trouble men are stationed. These calls may be trunked through from the company's P.B.X. board or come in on a direct line, the number of which is published in the local telephone directory. In addition to the publication of this number, the company has posted cards in fire stations, police stations and other points of public access. On these is printed in large type the names, addresses and telephone numbers of men in the line and appliance departments who may be called on if there is any difficulty in reaching the regular operator.

CONSUMERS POWER COMPANY
EMERGENCY CALLS

Operator on duty at all hours at Oakwood 2084 who will take all trouble or accident calls.

If unable to get operator at Oakwood 2084 call the persons in order named.

ELECTRIC LINE DEPARTMENT

John Markle,	705 Seventh St.	Oakwd 1485
Lloyd Southard,	760 W. Morrell St.	Oakwd 1868
Jim Van Ness,	260 Douglas St.	Oakwd 423-R
Geo. White,	707 N. East Ave.	Irving 664-M
Harry Weeks,	610 W. High St.	Irving 1083-M

ELECTRIC APPLIANCE TROUBLE

Harry French,	322 W. Wilkins St.	Oakwd 3596-R

GAS DISTRIBUTION DEPARTMENT

M. Nile,	740 Audubon Ave.	Oakwd 3081-W
O. G. Yeager,	226 Rosedale Place	Oakwd 1823-J
Otto Griffes,	185 W. Prospect St,	Oakwd 3719-J

GAS WORKS

Don Daykin,	802½ West Ave.	Oakwd 2143-W
Frank Dees,	221 W. Mason St.	Oakwd 2683-J
Lester Wolcott,	203 N. Wisner St.	Oakwd 574-M
George Fourscre,	109 N. Wisner St.	Oakwd 3922-R

CONSUMERS POWER COMPANY

INSTRUCTION FOR MAKING TROUBLE CALLS

The car in which trouble calls are answered is a light-weight roadster with a delivery box on the back. In this box are carried a supply of transformer and house fuses, a small collection of miscellaneous line material, rubber protective equipment and line tools. Although the regular trouble men do not come under the appliance repair department, they will make minor repairs on appliances and they frequently bring in irons and other devices for shop repair.

Typical of a month's activities, December, 1926, can be selected, during which the trouble men responded to 431 fuse replacement calls on the customers' premises, six transformer fuse outages, six cases of wires down, sixteen lamp replacements on signs and 204 calls on street lights. This is a total of 663 calls. The labor and automobile operation costs during this month were $660, thus indicating a cost of slightly less than $1 per call. The actual cost per call, however, was considerably less than this figure on account of the fact that although the trouble men were on duty all of the time, the time actually spent on calls was much less than the whole time of duty. The time of the trouble men in the shop between calls is occupied in repairing miscellaneous equipment, such as street-lighting units and the like, on which no labor record is kept.

TROUBLE CAR OF CONSUMERS POWER COMPANY

Fusion Temperature Determination*

THE many inconveniences and difficulties encountered in determining the fusion temperature of coal, ash and other material in the usual types of gas furnaces have led to the development and use in routine work of an electrical method and apparatus for making such determinations by the testing laboratories of the Public Service Electric & Gas Company (New Jersey).

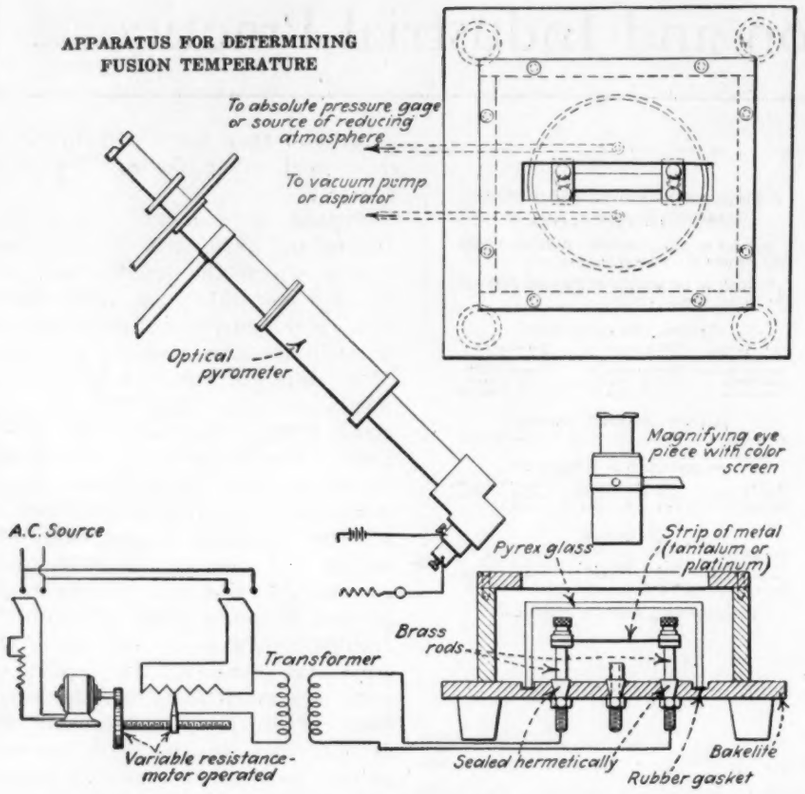
This method is believed by the user to be far simpler than the present cumbersome cone method, more accurate, and enables the study of the probable behavior of the various kinds of fuel, under conditions which may exist in the actual furnace.

The nature of the equipment is indicated in the accompanying figure.

In general all determinations are carried out in a vacuum. For the usual conditions, observations under reduced pressure do not require any clamping device for the glass cover, as the atmospheric pressure is sufficient to insure a tight joint. The use

*Extract from report of the prime movers committee of the National Electric Light Association.

APPARATUS FOR DETERMINING FUSION TEMPERATURE



of a tantulum strip requires a full vacuum, as tantalum oxidizes readily.

Motor control is used to obtain resistance variation. This arrangement is used, as it is favorable to a small current in the resistance; a uniform change in current gives a uniform increase in temperature of the metal strip and uniform heating of the material placed on the strip is obtained. Temperatures are determined by the use of an optical pyrometer in most cases, but a thermocouple with the junction brought close to the metal strip and properly calibrated may also be used. A suitable magnifier with the eyepiece covered with a blue-glass solariscope to protect the eye of the observer may be placed above the glass cover and focused upon the specimen.

The fusion can be easily observed when viewed through the magnifier as a thin white border which spreads around the specimen. When this border becomes visible, the pyrometer is read and the temperature recorded as the initial fusing point. The completion of the fusion is as distinct as the beginning. Toward the end the specimen loses its roughness and the moment the last rough and somewhat darker spot disappears the specimen is fused completely and the pyrometer reading is recorded as the final fusing temperature.

In order to exclude as much light as possible the fusion apparatus proper is placed in a box, of which the base of the apparatus forms the bottom, with a slot in the cover large enough to focus the pyrometer and magnifier on the metal strip and specimen. The specimen should be placed in direct contact with the strip, as serious error may otherwise be made due to poor contact, radiation from the container, etc. The current consumed by the apparatus is about 300 watts.

Charts for Line Calculations

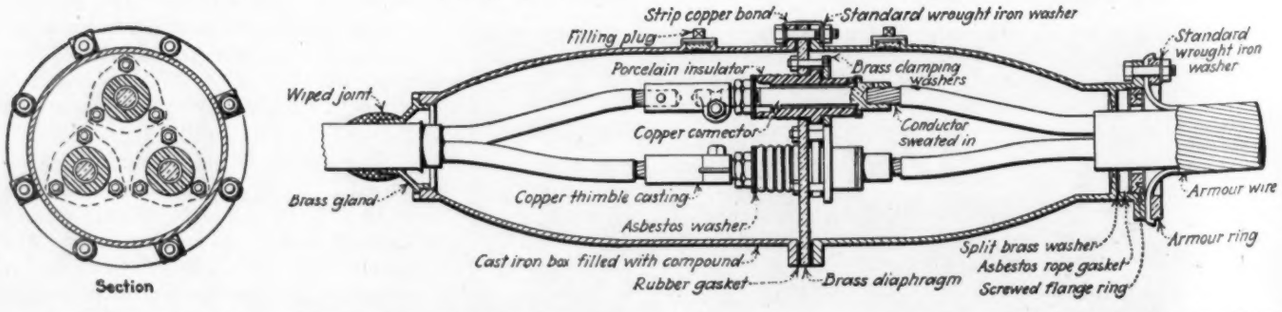
BY W. G. HICKLING
Electrical Engineer Penn Public Service Company, Johnstown, Pa.

FREQUENTLY it becomes necessary to add additional load to an existing transmission line or to build new lines, and the problem resolves itself into answering the following questions:

1. Will the existing lines take care of the additional load?
2. Is it economical to go to a higher voltage?
3. Shall a new line be built, and if so, what voltage and what size wire shall be used?

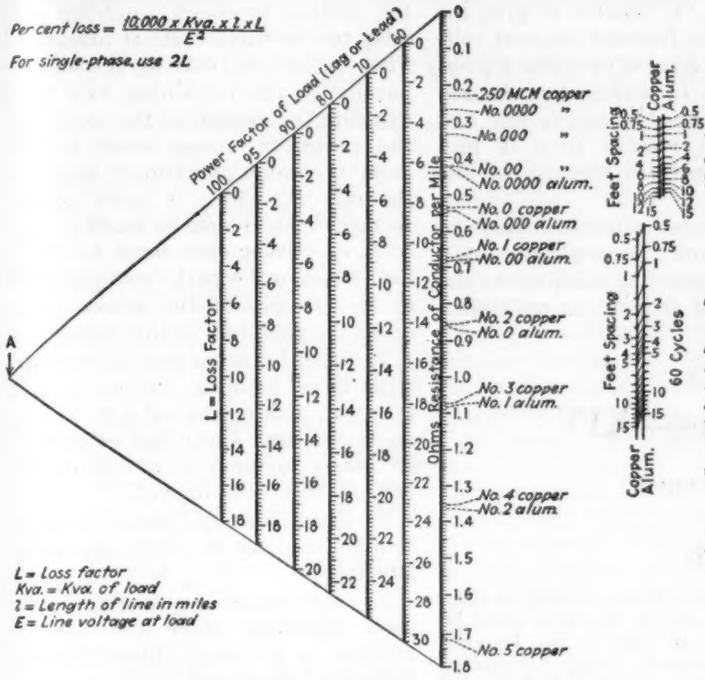
The answers to these questions lie in striking an economical balance that takes into account power loss and construction costs as represented in dollars, and in voltage drop as represented in service rendered to the consumer. By means of the accompanying charts the questions of

Joint Splice Combining Paper-Insulated and Rubber-Insulated Cable

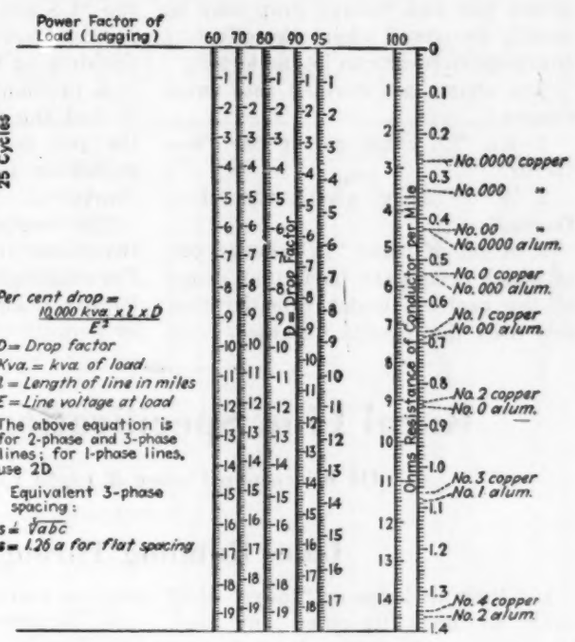


DETAILS of the splicing from paper-insulated to rubber-insulated cable at the west abutment of the drawbridge across Newark Bay of the Central Railroad of New Jersey are shown in the accompanying drawing. This installation, designed and constructed by the Public Service Production Company, Newark, N. J., was described at some length in the April 23 issue of ELECTRICAL WORLD, page 869.

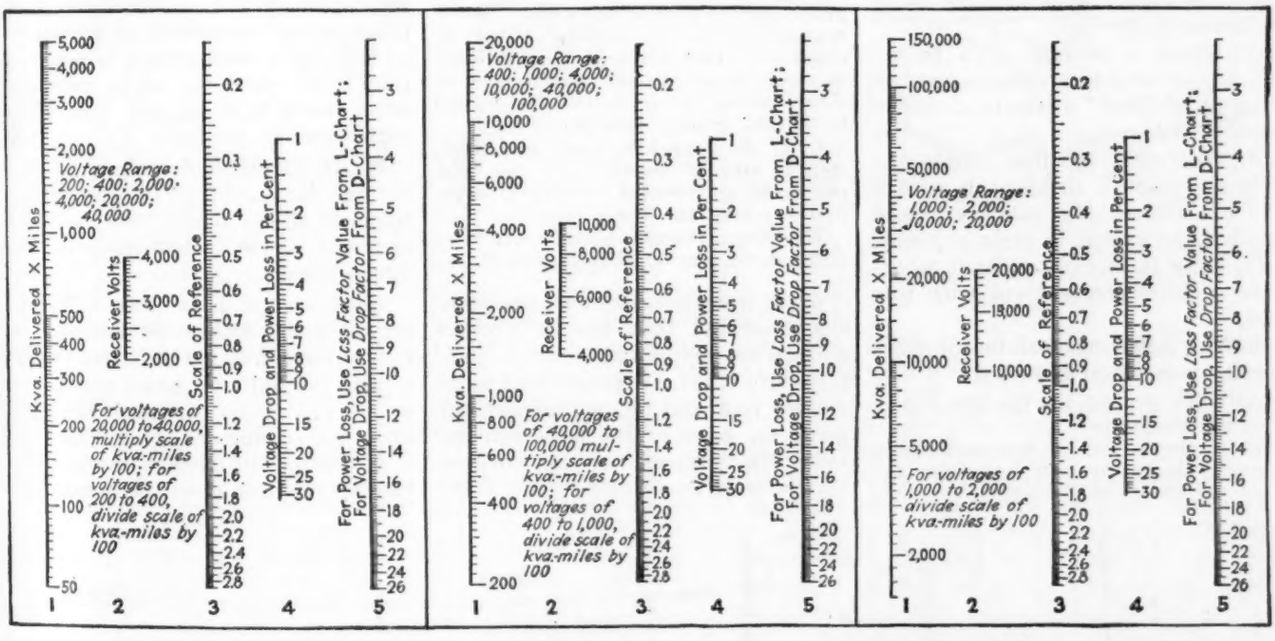
A shield about 3 ft. long and 14 in. in diameter, divided into two equal cylinders by a porcelain barrier, was employed in effecting the splice. The lead was wiped to this shield on one side and the armor held in position by it on the other. Three conductors entering each end were connected in the usual manner. The two portions of the shield, separated by the porcelain barrier, were filled with the respective compounds usually employed in splicing paper-insulated and rubber-insulated cable.



"L" CHART FOR DETERMINING POWER LOSSES OF TWO-PHASE AND THREE-PHASE TRANSMISSION LINES


Power Factor of Load (Lagging)
60 70 80 90 95 100
D = Drop Factor
Ohms Resistance of Conductor per Mile
No. 0000 copper
No. 000 "
No. 00 "
No. 0000 alum.
No. 0 copper
No. 000 alum.
No. 1 copper
No. 00 alum.
No. 2 copper
No. 0 alum.
No. 3 copper
No. 1 alum.
No. 4 copper
No. 2 alum.
Per cent drop = 10,000 kva. x l x D / E²
D = Drop factor
Kva. = kva. of load
l = Length of line in miles
E = Line voltage at load
The above equation is for 2-phase and 3-phase lines; for 1-phase lines, use 2D
Equivalent 3-phase spacing:
s = ∛abc
s = 1.26 a for flat spacing

"D" CHART FOR SECURING VALUES OF VOLTAGE DROP OF TRANSMISSION LINES


Kva. Delivered X Miles
Receiver Volts
Scale of Reference
Voltage Drop and Power Loss in Per Cent
For Power Loss, Use Loss Factor Value From L-Chart; For Voltage Drop, Use Drop Factor From D-Chart
Voltage Range: 200; 400; 2,000; 4,000; 20,000; 40,000
For voltages of 20,000 to 40,000, multiply scale of kva.-miles by 100; for voltages of 200 to 400, divide scale of kva.-miles by 100
Voltage Range: 400; 1,000; 4,000; 10,000; 40,000; 100,000
For voltages of 40,000 to 100,000 multiply scale of kva.-miles by 100; for voltages of 400 to 1,000, divide scale of kva.-miles by 100
Voltage Range: 1,000; 2,000; 10,000; 20,000
For voltages of 1,000 to 2,000 divide scale of kva.-miles by 100
1 2 3 4 5

"H" CHARTS FOR TRANSMISSION LINE CALCULATIONS RANGING IN VOLTAGE VALUES FROM 1,000 TO 100,000 VOLTS

Problem

Power transmitted .....400 kva.
Power factor of load.....90 lagging
Distance .....1½ miles
Receiver voltage .....2,200 volts
Equivalent spacing of conductors....12 in.
Frequency .....60 cycles
Conductor material .....Copper
Conductor size .....No. 1

Solution

Turn to the "L" chart and lay a straight edge from point *A* to the wire size (No. 1) and on the 90 per cent power factor line read the value $L = 7.5$

Turn to the "H" chart for 2,000-4,000 volts. The kilovolt-amperage delivered multiplied by 1½ miles in the problem is 600 kva. miles. Lay a straight edge on the third scale, which is a reference scale. Next lay a straight edge from this point 1.26 on the No. 3 scale across to the value found for *L* on scale 5 and read the per cent power loss on scale 4, this being 9.4 from inspection.

To find the voltage drop, turn to the "D" chart and with a straight edge connecting the spacing value 12 in. and the wire size No. 1 read the drop factor on line, *D*. This is found to be 8.5 for 90 per cent power factor.

Referring again to the "H" chart, connect the point 1.26 to the value 8.5 on scale 5 and a value for the voltage drop of 11 per cent will be obtained on scale 4.

Modification of Result

If this voltage drop is considered excessive for the conditions of the work and must be reduced to a less value, possibly 7 per cent, further use of the charts may be made in determining the different size wire that must be employed.

On the "H" chart lay a straight edge from 1.26 on scale 3 to the value 7 per cent on scale 4 and read the value on scale 5 which is 5.5.

Returning then to the "D" chart, lay a straight edge from the value of spacing (12 in.) across to 5.5 on the 90 deg. power factor line, and it will be found that a wire size between 000 and 00 must be used. The power loss for the new value of voltage drop over 000 wire could then be determined from the "L" chart in the same manner as originally shown except that the reference would be to the 000 wire size.

power loss and voltage drop may be readily answered where the effect of charging current can be neglected.

The charts are divided into three classes:

1. An "L" chart giving the "loss factor."

2. A "D" chart giving the "drop factor."

3. A set of three "H" charts, one of which covers the particular range of the problem under consideration and uses the results obtained from the "L" and "D" charts to give the per cent power loss and per cent voltage drop in terms of receiver values.

A problem in which it is desired to find the per cent power loss and the per cent voltage drop is presented to illustrate the use of the charts.

The methods outlined apply to two-phase and three-phase lines. For single-phase line calculations the factors *L* and *D* must be multiplied by two.

Rural Line Specifications—XIV

Of Wisconsin Power & Light Company

Lines Running Through

1. Climbing irons or "spurs" shall *never* be used to climb any tree. Use ladders where necessary.

2. Where there is tree interference and pruning is necessary, it is usually desirable to remove entire branches rather than just the twigs or branch ends only.

3. Where a branch is to be removed, go back to a suitable natural division or "fork" of the tree. *Never leave a stub end.*

4. Wherever possible climb the tree and remove the branch with a sharp handsaw. The pole saw should not be used except in cases of necessity, since it is more difficult to secure a clean, straight cut with this tool.

5. The following shall be the rules for the removal of branches:

A. Make a notch on the lower side, near the final cut.

B. If the branch is heavy, make a second cut one or two feet from the final cut and from the upper side, cutting the branch off and leaving a stub.

C. The removal of this stub shall be the final cut. It shall be at the very base of the branch, being amputated with a cut as nearly parallel to and even with the outline of the main axis of the limb or the trunk as possible, leaving no portion of the amputated branch on the limb or the trunk. Many branches have a swelling bulge or shoulder. This must be cut through in order to satisfy the requirement of close cutting, even though the wound is thereby greatly enlarged.

D. If the branch is small and light, step B may be omitted and the final cut made as directed in step C after first notching the lower side.

(Note to linemen—Play safe and make three cuts on all branches.)

6. All wounds must be immediately smoothed and then heavily dressed with an antiseptic, impenetrable (waterproof) cover. Common lead paint (white lead and oil, no turpentine) made the color of the bark will answer the purpose, or carbolineum may be used, preferably warm. Make the coating thorough, applying possibly two or three coats if necessary. The object of cutting close and parallel to the remaining axis is to expedite the closing of the wound by the callus or wound wood formed from the cambium (inner bark) at the margin, which is more readily formed when the cut is made as prescribed. Great care must be taken not to loosen the bark from the wood at the margin of the wound or to crush the cambium in this region.

7. Small branches may be removed with hand pruning shears or pole trimmer, making the cut ¼ in. to ½ in. above the next lower bud or branchlet (early spring ¼ in. above; during dry weather ½ in. above).

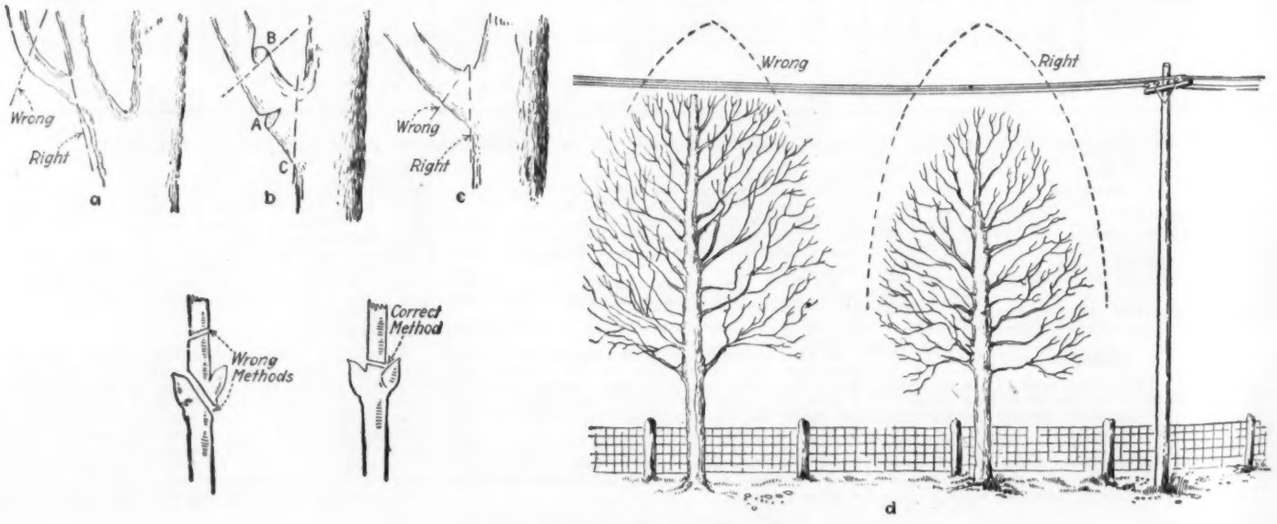
8. When possible, heavy pruning should be done in early spring or late fall.

9. Tree insulators should not be used whenever their use can be avoided by pruning, side-arming or the use of tree wire.

10. The trunks of trees or large limbs should not be used for temporary anchors for construction purposes, unless adequately protected by padding or unless a hook is screwed into tree, which is to be removed when work is done and hole filled with wax and plugged.

11. If considerable trimming has to be done, the tree should be trimmed up so that it will be symmetrical, as indicated in *e* in the figure below.

All branches that have been removed must either be burned or hauled away and not permitted to lie around indefinitely. Brush should not be burned under or near the line after the conductors are in place, as it is possible to damage the conductors by the heat from the brush fire.



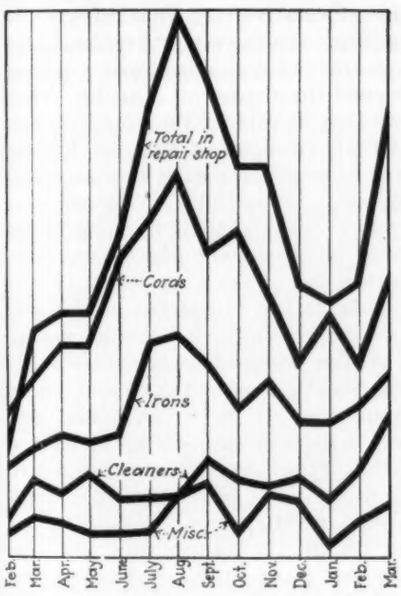
TREE PRUNING AND TRIMMING

Commercial Activities and Public Relations

Appliance Repair Service Has Summer Peak

By J. A. Jorgenson
Superintendent of Appliance Department, Jackson District, Consumers Power Company, Jackson, Mich.

THE appliance repair departments of the Consumers Power Company are operated on the theory that a gas or electricity-consuming device that is out of repair is not consuming



SHOP REPAIRS OF APPLIANCES ARE HIGHEST IN AUGUST

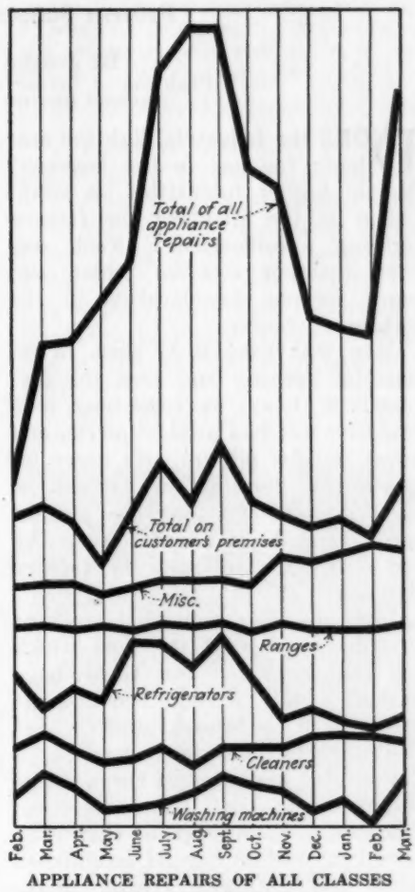
energy and is therefore not returning any revenue to the company. From this has resulted a very generous service policy.

The company gives daily nine-hour service on all appliances except refrigerators and gas furnaces, which are serviced at any time of the day or night. The crew consists of four men, all of them on general appliance repair. Two of these men have been specially trained in electric refrigeration and in addition to servicing refrigerators they also install them.

Records of calls on various appliances and equipment showing work done on customer's premises and in the repair shop are kept daily and are entered on a sheet that covers a complete month. An inspection of the sheet for February, 1927, does not corroborate the general impression that all washings are done on Monday and all ironings on Tuesday, if one is to judge from the number of service calls on the appliances used in this necessary work. As a matter of fact, there seems to be no rhyme or reason in the distribution of service calls throughout the week on the various classes of appliances. For instance, the greatest number of service calls on washing machines occurred on a Thursday and this number was nearly twice as many as the maximum on any other day during the month. The greatest number of calls on electric irons occurred on a Saturday and this number was more than twice the daily average of the month.

Except in the case of refrigerators, of which there are about 200 installed, no data are available on the total number of different appliances in use in the Jackson district. The aggregate number of meters serving the homes in which these appliances are in use is 15,385.

The accompanying tabulation and curves indicate that there is some relation between the use of electrical appliances and the seasons of the year. The first set of curves shows the repairs made on the customer's premises and the second set shows repairs made in the shop, together with a curve of all appliance repairs in and out of the shop. The total curves show very sharp peaks during the summer months, and it is significant that the largest contributors to these peaks are irons and refrigerators, indicating a larger use of these appliances during hot weather, together with appliance cords, which indicate a generally larger use of electric appliances during the summer months. This indication gains added evidence from the fact that all appliances, except refrigerators, show an upward turn in the curve, very sharp in some cases, during the March months shown on the graphs. From this collection of data and curves one is almost forced to conclude that electric appliances in general are regarded by the public as things to be used under certain seasonal conditions and that they are not yet established in the public consciousness wholly as devices for year-around use.



APPLIANCE REPAIRS OF ALL CLASSES HAVE A SUMMER PEAK

MONTHLY RECORD OF APPLIANCE REPAIRS

Month	Cleaners	Cords	Elec. Irons	Misc.	Total	Wash.	Cleaners	Irons	Re-Refrig.	Elec. Ranges	Misc.	Total	Grand Total
February	35	105	20	37	201	70	33	2	85	3	11	204	407
March	64	134	35	50	289	89	42	2	59	7	12	211	500
April	52	155	43	45	301	77	31	3	74	2	13	200	501
May	68	154	38	36	304	60	22	3	66	6	7	164	468
June	48	215	43	37	344	62	24	5	106	2	11	205	554
July	51	238	106	38	445	66	34	6	105	8	16	235	680
August	52	272	110	63	505	72	20	4	87	7	18	208	711
September	78	215	90	71	458	87	34	..	111	9	18	259	717
October	63	234	60	36	402	78	34	4	82	1	15	214	616
November	57	192	80	56	399	74	35	9	52	8	31	209	608
December	64	141	50	59	318	60	42	5	60	3	28	198	516
January	48	177	49	27	303	69	43	6	51	2	34	205	568
February	69	139	62	44	317	51	44	7	45	2	42	193	508
March	103	192	85	59	444	84	38	5	54	7	38	226	670

Does the Factory Lighting Star Need Hoisting?

Nation-Wide Campaigns Have Secured Results—Users Convinced—Results Offer Economic Justification—Should Present Standards Be Raised

BY JOSEPH F. BECKER
Chairman of Industrial Lighting Committee
National Electric Light Association

DOES the industrial lighting star hang too low in the heavens? Should higher intensities be established as the standard for factory lighting specifications? Each day this question receives wider and more serious consideration in the lighting industry.

Men who have lived close to industrial lighting and seen the dividends it always pays the user, men who have watched production rise and other benefits pile up with every increase in illumination intensities, have long known that the present recommended standards were by no means the ultimate in factory lighting.

In many cases industrial concerns that have achieved the goal which lighting men set for them have basked awhile in the benefits the better lighting brought and then of their own initiative have hung up a higher star and climbed the wattage ladder up to that. Nor does one hear from them regrets that they have ventured on beyond established goals and gathered greater quantities of electrical sunshine.

Oftentimes those of us who most fully appreciate the advantages of a good thing hesitate to tell the whole truth lest we be accused of exaggeration. Certainly there is evidence that industrial lighting is being undersold, perhaps through fear that if the full facts were presented all at once they would sound like myths.

Just a few years ago a large factory in the Middle West was pointed out by lighting men as an ideally lighted plant. Visitors from other cities were taken to it for inspiration and then were told how the excellent lighting had increased production, decreased accidents and paid its way in a dozen other savings.

Then one day, while the applause of its lighting system was at its height, this concern doubled the wattage of the installation already thought by many to be ideal. That the results of bettering the best were satisfactory has been proved by the fact that the company has since moved into new quarters and kept its lighting intensities up to the high standard it set when it doubled an ideal.

It is true that the great majority of the factories of the country are still poorly lighted, but it is equally true that whenever a factory has had experience with good lighting it never returns to the gloom of the past, but usually seeks still greater improvements in lighting conditions.

REWARDS ARE TANGIBLE

Many factories in all parts of the United States are now reaping the rewards of better lighting as a result of the nation-wide industrial lighting campaign of 1926. The lighting men who made those installations and have seen the satisfaction that is derived from them are more enthusiastic and efficient in their promotion of good lighting than ever before.

The industrial lighting campaign continues this year. Each good installation is making it easier to sell another good installation. Just as a well-kept house and lawn on a residence street are an inspiration that leads to other well-kept homes in the neighborhood, so a well-lighted factory in a community is a powerful influence in raising the lighting standards in other factories of the community.

Central-station men, jobbers' salesmen and contractors who attended an illumination course offered recently by one of the lamp manufacturers reflected the greater understanding and appreciation of good industrial lighting that is springing up everywhere and that has been so greatly stimulated by the organized activity of the entire industry.

Whereas in past years it has been difficult to key those who attended similar courses up to a point where they would with confidence go out and sell industrial lighting installations of intensities as high as those recommended in the course, the students this year were practically unanimous in their opinion that installations of still higher intensities should be recommended as standard.

These men, who had been in contact with industrial concerns, had found out that present standards are conservative—"ultra-conservative," they say. Practically all those attending the course knew of factories that had installed wattages much higher than those set down as a good standard and had found them profitable and practical. It was the opinion of some that the standards now commonly specified are a handicap that holds back many who might otherwise easily and wisely be led to install more powerful lighting systems.

Should the industrial lighting star be hoisted higher? Those upholding the affirmative say that higher intensities than are now recommended have proved economical and practical beyond the shadow of a doubt. They say that by raising the general standard of recommendations a barrier will be removed that is now restraining some industrial lighting concerns from improving their lighting to the point where it will pay the greatest dividends. They say that if the standards are raised those who now have poorly lighted factories, seeing a greater spread between their existing lighting conditions and those recognized as most desirable, will feel a greater urge to go at least a little further along the road to better lighting. It is believed that if these plants see that they are lagging too far behind the leaders they will take the first steps in the right direction and then, seeing that these steps are profitable, they will be more apt to go the whole way.

INERTIA DOMINATES

On the other hand, however, there are those who feel that even though many factories may have already gone beyond present standards of industrial lighting and found their investment profitable, the majority of factories are still very poorly lighted and that therefore standards should not be raised until a greater percentage of factories have climbed to within reach of the existing lighting standards.

Those who hold this latter belief say that if you are walking beside a man and quicken your pace he will quicken his, but that if you burst into a sprint he will probably decide that you have gone crazy and keep on walking as slowly as before.

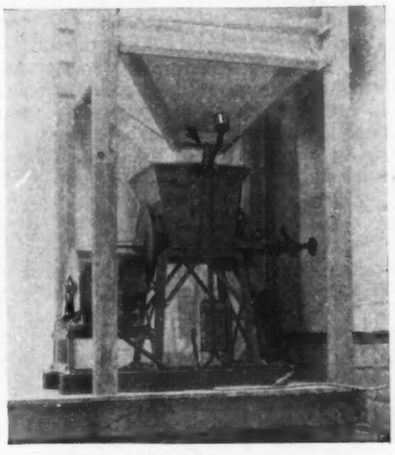
What do you think? Does the industrial lighting star need hoisting or is it hanging high enough for the present?

Automatic Feed Grinders

BY FRANKLIN J. ZINK
Field Engineer Iowa Project on Rural Electrification, Garner, Iowa

THE idea of using automatic machines for grinding feed on Iowa farms came up early in the rural electrification experimental work conducted by the Iowa State College. Graduate students in the agricultural engineering department conducted the laboratory work in assembling and testing these machines.

The requirement of operation is the reduction of the speed of the grinder to the point where it may be operated by a 1-hp. electric motor. The grain is supplied to the grinder from a magazine bin and the ground



AUTOMATIC GRINDER INSTALLATION

Grinder "A," 6-in. burr mill, 1-hp. Century motor, Tork clock time switch and quantity control which is shown at "V."

feed discharged into a similar bin. The problem of a magazine supply bin is already solved on many corn belt farms where overhead grain storage is practiced. The receiving bin for the ground feed can be either the floor of a feed room or a box mounted on small truck casters so that it may be moved about. The grinder itself is mounted on top of the receiving bin. The size of the receiving bin, theoretically, need be only large enough to hold one day's supply of feed. By means of spouts to various bins several kinds of grain may be ground.

The automatic devices consist of time switches and quantity controls. The quantity control is a motor shut-off device operated by a valve in the bottom of the supply bin.

The grinder can be operated during the night time or station off-peak hours. The "B" machine, later referred to, ground six to seven tons of grain during the night, operating to between 5 and 6 o'clock in the morning. In order to make night operation general, more incentive for it must be offered the farmer. However, even though the machine is not operated at night, sufficient improvement of the electrical factors is shown to make automatic grinding a very desirable farm load.

Last season's results on these machines are shown by the following detailed information:

Grinder "A"

Description and Operation.—A 6-in. burr grinder, 1-hp. Century motor, gear drive, grinder speed 150 r.p.m., Tork clock time switch and shut-off device when grain is ground from hopper.

From August, 1926, to May, 1927, inclusive, 10 tons of oats was ground to a medium fineness for dairy cow feed. The dairy herd averaged between fourteen and fifteen cows.

Energy Consumption.—0.73 kw.-hr. per 100 lb. of oats.

Power Cost.—4.3 cents per 100 lb. of oats.

Total Cost.—For grinding, including interest and depreciation, 15.7 cents per 100 lb. of oats.

Grinding this same feed at the mill, the cost would have been approximately 20.7 cents per 100 lb. Using the automatic mill resulted in a net saving of 5 cents per hundred.

Grinder "B"

Description and Operation.—A 4-in. burr grinder, 1-hp. Century motor, Tork clock time switch and shut-off device when grain is all ground from hopper. Belt drive with a grinder speed of 375 r.p.m.

Approximately 550 bushels of barley was ground during early fall months for feeding young pigs. This number of bushels would be about 23,600 lb., which required 105 kw.-hr. of electricity. The barley was ground to a medium fineness.

TABLE I—ELECTRICAL FACTORS

	5-Hp. Grinder	Automatic Grinder Daytime Operation	Night-time Operation
Diversity factor	1.27	1.37	1.57
Demand factor, per cent	47.5	25.3	22.1
Load factor, per cent	1.86	3.5	4.0

TABLE II—COSTS, AUTOMATIC OPERATION

	Grinder "A"	Grinder "B"	10-In. Burr 5-Hp. Motor
Grinder	$35.00	$12.00	$75.00
Motor	65.00	65.00	180.00
Drive	5.50	2.50	5.00
Frame for assembly	5.00	2.00	2.00
Electrical installation	4.30	4.30	15.00
Automatic drives	32.50	30.00	.....
Total capital investment	$146.30	$110.00	$277.00

Energy Consumption.—0.445 kw.-hr. per 100 lb.

Power Cost.—3.3 cents per 100 lb.

Total Cost.—For grinding, including interest and depreciation, approximately 11.8 cents per hundred.

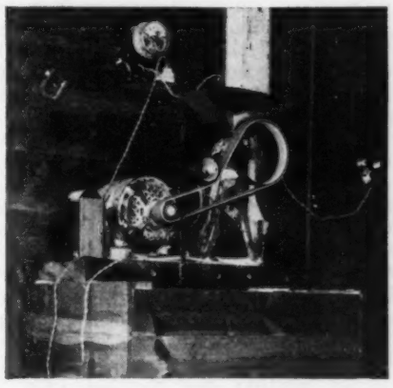
Hauling this same grain to a custom mill for grinding would cost approximately 22 cents per 100 lb. Using the automatic mill resulted in a net saving of 10.2 cents per hundred.

COMPARISON OF FACTORS AND COSTS

A comparison of the electrical factors on a typical farm using a 5-hp. motor and large grinder with those factors if an automatic device were used instead is shown in Table I.

A comparison of the investments in the various machines as well as cost of different devices is shown in Table II.

In general, the results of the field



GRINDER WITH REMOVABLE BIN

Grinder "B" with 1-hp. Century motor, Tork clock time switch, receiving bin on truck casters open at one end for shoveling out ground feed, and supply chute to hopper from overhead driveway grain storage bins.

testing on the Iowa project on rural electrification of these two automatic grinders support those results obtained previously in the laboratory of the agricultural engineering department of the Iowa State College. The conclusions are:

1. A small motor has been used satisfactorily for feed grinding.
2. Time control is proving practical.
3. Quantity control can be arranged.
4. The small grinder has as high an efficiency as the large grinder and is cheaper to operate.
5. The use of the magazine bin saves valuable labor as it requires little attention.
6. Savings may be made over custom mill grinding and grinding with a larger motor and mill.
7. Electrically the farm diversity, demand and load factors are improved to a great extent.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Service Factors Governing the Slagging of Boiler-Furnace Refractories.—RALPH A. SHERMAN and EDMUND TAYLOR.—This is a progress report of the A.S.M.E. special research committee on boiler-furnace refractories. Service factors considered are refractory temperatures, furnace-gas temperatures, furnace-gas composition, furnace-gas velocities, slag composition and slag quantities. Values for part or all of these factors have been determined for Eastern bituminous coals on underfeed stokers, powdered Eastern bituminous coals in furnaces with extended radiant-heat-absorbing surface, high-sulphur Pittsburgh coal on underfeed stokers, low-sulphur Pittsburgh coal on underfeed stokers, high-sulphur Pittsburgh coal on chain-grate stokers, Illinois coal on chain-grate stokers and powdered Illinois coal. This investigation covered the factors involved, the type of coal furnished and the method of burning it, factors affecting refractories being considered as a separate problem. — *Mechanical Engineering*, July, 1927.

Heat Rates for Steam-Power Stations Compared.—P. H. HARDIE.—The economics of power-plant operation are stated in relation to heat losses at different ratings and the improvement in turbo-generator heat rates when utilizing regenerative feed heating. The author concludes that if the load factor is known it is not difficult to decide whether the thermal gain is sufficient to pay for the cost of the installation of economizing apparatus and offers a number of curves which may be used as the basis for determining the equipment that may justifiably be included in the plant layout.—*Power*, Aug. 2, 1927.

Higher Steam Pressures and Temperatures.—THOMAS ROLES.—A discussion of the economy which theoretically may result from the use of higher steam pressures has been developed fundamentally by reference to the temperature-entropy diagrams constructed for different temperatures and pressures. The author states that the utilization of the B.t.u. available in steam at 1,500 lb. per square inch pressure is greater by 26 per cent than that which is potentially usable at 200 lb. per square inch pressure. On the basis of these entropy diagrams a number of other curves illustrating the economy which may be theoretically obtainable are derived. The relation of the increased economy to capital investments and charges has also received considerable attention in this article.—*Power*, Aug. 16, 1927.

Illumination

Relation Between Illumination and Efficiency in Fine Processes.—H. C. WESTON.—Special reference is made in this article to the lighting of printing works. The results obtained in increased efficiency, through the elimination of errors and an increase in the speed of operation, are indicated in this report of a somewhat extensive study. The investigation was undertaken for the Industrial Fatigue Research Board and the Illumination Research Committee, both of Great Britain. Conditions were varied so that the degree of illumination ranged in values from 1.3 ft.-candles to approximately 25 ft.-candles. Different systems for securing the lighting effects ranging from direct to wholly indirect were tried. The results show errors of various kinds with six different intensities and six methods of securing the effects.—*Illuminating Engineer* (*England*), August, 1927.

Transmission, Substations and Distribution

A 21,000-Kva. Automatic Substation.—D. W. ELLYSON.—The use of bus-tie oil circuit breakers and sectionalized buses permits an unusual handling of the station load of this automatic substation. The 2,300-4,400-volt bus is arranged in three sections. A separate transformer bank is used to feed each section of the bus so that in case of light loads the three sections are tied together and fed from one bank, while as the load increases a second bank is cut in and the bus split into two sections. Upon still further increase in load, the third bank is cut in and the bus is split into three sections. The bus sectionalizing limits the amount of power that can be fed from the power house into a fault in or beyond the substation. As the result of experiences with this and two other automatic substations, the Kansas City Power & Light Company is planning to carry the entire 2,300-4,400-volt city load with automatically controlled equipment.—*Journal American Institute of Electrical Engineers*, August, 1927.

Automatic Substations. — Apparatus and equipment of a type used in modern British practice for service in automatic substations are described in this article. The various types of relays and controls and features in the design of high-speed circuit breakers are mentioned. The use of the cam-shaft controller and its adaptation to supervisory and automatic control and operation are explained.—*Electrician* (*England*), Aug. 5, 1927.

Mechanical Forces in Transformers.—J. E. CLEM.—Increases in the size of transformers and enlargement of the power system make the subject of the mechanical forces set up on short circuit of great importance. It is essential that the bracing structure be proportioned properly. The author has endeavored to point this out and has developed a formula for the mutual inductance between coaxial solenoids, which leads to a formula for the mechanical force between concentric cylindrical transformer coils and between individual coaxial coils. Calculations for the reaction of complicated wiring and winding arrangements are made on such a basis that the voltage may be calculated accurately and that the forced calculation as based on the differential of the voltage equation shall then be accurate. This was done because the voltages may be measured more easily than the forces.—*Journal American Institute of Electrical Engineers*, August, 1927.

Generation, Control, Switching and Protection

Truck-Type Switchboard. — F. M. BILLHIMER.—This is a presentation in a non-technical manner of the operating advantages of truck-type switchboards. It is pointed out that because all high-voltage parts are inclosed, the framework of the housing and the truck being grounded and the equipment itself thoroughly interlocked, these devices incorporate a number of safety factors. The low maintenance cost, due to the flexibility which permits repairs to be made when and where it is found to be most convenient, and the practical elimination of interruptions of any considerable duration because of the failure of switches, meters or relay equipment are mentioned. Industrial service is foreseen as requiring a wide use of this class of switches because of the many advantages of the type.—*Industrial Engineer*, August, 1927.

Insulation and Winding of Induction Regulators.—R. E. DAWE.—The various technical features involved in the manufacture and assembly of induction regulators are discussed here. The several types of winding and insulation and methods of bracing are described, with particular attention to the importance and methods of obtaining satisfactory results in bracing conductors.—*Electric Journal*, August, 1927.

Potential Transformer Connections for Three-Phase, Four-Wire Metering.—L. D. PRICE.—The use of the standard three-phase, four-wire metering schemes on all 4,150-volt installations presents a problem in determining the proper potential transformer connection to be used when the line neutral is not connected to the power transformer bank. If three transformers are connected with primaries in star to a three-phase, four-wire grounded neutral line and the voltage supplied is sinusoidal, there will be a third harmonic component in the magnetizing current of each phase. This is due to the variation in permeability of the transformer core with varying flux densities. The third harmonic currents will flow over the three lines and return through the neutral, where they will be in phase and hence add directly. If the neutral is broken, eliminating the return path for the third harmonic magnetizing currents, none can flow; therefore the magnetic flux of the cores will be so modified that the third harmonic voltages will be induced in the secondaries. These voltages will appear only between lines and neutrals, as they are in opposition and therefore neutralize between lines. If the secondaries of the transformers are connected in delta, the third harmonic voltages induced in them will be in phase and will set up a circulating third harmonic current in the delta. This acts as a

magnetizing current for the core, suppressing the third harmonic in the induced voltage. The author cites test results of several experimental wiring arrangements and suggests one as being highly desirable for use with these three-phase, four-wire installations where the neutral is not connected to the load.—*Electric Journal*, August, 1927.

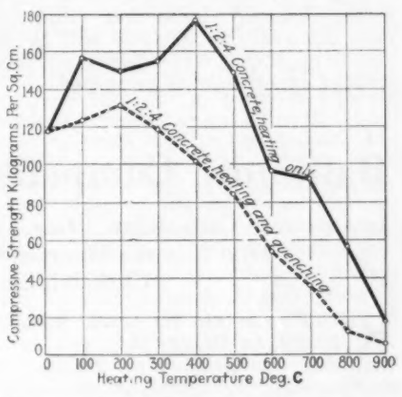
Miscellaneous

Electricity in the Drilling of Oil Wells.—L. J. MURPHY.—The characteristics of the various methods of drilling used in the oil field require that the average speed of the drilling equipment be adjustable at all times to correspond exactly to the natural period of the drilling tools and drilling lines, if maximum progress is to be obtained. Power requirements vary also, and it has been necessary to make certain variations in the design of equipment to meet special conditions. The author discusses the adaptation of electricity to the various classes and methods of drilling processes. As a large proportion of the difficulties in rotary drilling are caused by the improper feeding of the drill because of errors in judgment and failure to properly operate it, an automatic rotary drilling device has been developed. This device not only tends to keep the load on the drill pipe constant for any given setting but also tends to hold the pipe on the bottom at all times with a constant pressure. If the load on the drill suddenly becomes excessive, the drill is raised until the bit is free of the obstruction, after which downward progress is again resumed.—*Journal American Institute of Electrical Engineers*, August, 1927.

Observations on the Microstructure of the Path of Fatigue Failure in a Specimen of Armco Iron.—FRANCIS F. LUCAS.—A co-operative study of the microstructure of the path of fatigue failure conducted under the auspices of the National Research Council. The paths of fatigue failures in specimens of Armco iron are shown. Non-metallic inclusions act as stepping stones for the crack. Inclusions thus seem to influence the origin and trend of the crack. Grain boundaries do not appear to be a potential source of weakness. Reversed cycles of stress appear to produce disturbances in the structure of the metal in advance of the visible crack. Disturbances in the metal structure adjoining the path of fatigue failure seem to be highly localized to the immediate neighborhood of the cracks.—*Reprint No. B-257, Bell Telephone Laboratories.*

Electrification of Steam Railroads.—A survey and analysis of installations of electric operation on steam railroad lines in the United States and foreign countries has been prepared by a committee of the National Electric Light Association. In the tabulated figures data are given for each installation, including the location of the line, route and track mileage, system of electrification installed (showing voltages), direct or alternating current supplied and method of receiving the current, the date of electrification, the type of service to which the installation applies and, so far as possible, the direct reasons for changing over from steam equipment and service. The committee has also endeavored to indicate briefly the operating economy and service convenience effected in each of the several organizations. The reason for electrification in a great majority of the projects was the necessity for increased capacity, and it is indicated that this object was fully accomplished. For this reason, if for no other, future demands in the United States for efficient and adequate service are foreseen to require greatly increased use of railway electrification. — *National Electric Light Association Committee Report*, 1927.

Effects of Temperature and Humidity on the Properties of Cement and Mixtures.—MASAO HIRANO.—It has been the endeavor of the author to investigate the effects of high temperature and humidity upon the satisfactory use of cement and its mixtures. The various properties of mortar and concrete at ordinary temperature and also at lower temperatures are comparatively well understood. An effort is made in this treatise to determine the effects of admixture on the properties of mortar and concrete. The result of heating and quenching upon the strength of cement, the distribution of heat through the concrete mass, the effects of temperature and humidity upon the time of "set" of cement and their effects upon the strength of mortar and concrete, and the thermal expansion of cement mortars with or without an admixture, have had a thorough investigation. The results show that the compressive strength of mortar is raised by heating to a temperature of 300 deg. C. The percentage gained varies from 20 to 150 per cent, the largest increase being found where smaller amounts of cement are used in the mixture. Quenching reduces the strength obtained by heating. The tensile strength is increased by heating. The assumption that both concrete and steel have about the same value of thermal expansion may be correct only at low temperature ranges. At 500 deg. C. or more the assumption is quite erroneous.—*Vol. IV. No. 5. Memoirs of the College of Engineering, Kyoto Imperial University.*



EFFECT OF QUENCHING UPON THE STRENGTH OF HEATED CONCRETE

Motors and Control

A Study of Transverse Armature Reaction in Synchronous Machines.—R. A. SCHAEFER.—This study was undertaken by means of a standard synchronous machine and a second one with an adjustable stator. The failure of synchronous machines, when operated under certain conditions, to function according to the theories developed for them led to the investigation. The variations from predicted results are not of serious consequence under normal operating conditions, according to the author, but are widely in error when operation on charging a long unloaded transmission line, synchronizing power and pull-out torque are computed from the design constants. The author defines transverse armature reaction as the effect that the magnetic flux produced by the armature has upon the field flux, when the armature reaction is entirely cross-magnetizing and states that this occurs when the current reaches its maximum value in a conductor under the center of the pole. In a generator the armature reaction is not entirely cross-magnetizing when the machine is delivering a current of unity power factor, because the flux produced by the armature strengthens the flux on one side of the pole and weakens it on the other, thus producing a considerable phase angle between the voltage at no load and the voltage at full load. As a result of experimental investigation and calculations from these figures, it is concluded that the tests employed are too technical in nature to be of value as a routine operation to determine conformance with the purchaser's specifications. The essential value is foreseen as a source of useful information to aid the engineer in checking the design constants of his machine.—*Journal American Institute of Electrical Engineers*, August, 1927.

Bearing Currents—Their Origin and Prevention. — C. T. PEARCE. — Bearing currents are defined by the author as stray currents which flow between the shaft and bearings. When of sufficient magnitude they will cause arcing between these parts, injuring one or both surfaces. These currents are encountered because of a lack in design or construction of balance and symmetry and are usually due to the ampere-turns linking the shaft and the flux linking the shaft. The first cause is characteristic of direct-current machines, and the second, which is by far the more important, may occur in either direct-current or alternating-current machines, but is confined mostly to large alternating-current apparatus of higher ratings than those for which direct-current apparatus is constructed. The methods of remedying this situation by various means for different numbers of multiple-pole machines are given. The author says that, although it is impossible to calculate the magnitude of these currents, their presence may often be predicted. It is stated that with proper precautions and adjustments the pitting and subsequent failure of the bearing due to roughened surfaces and loose particles of metal can be avoided almost entirely. — *Electrical Journal*, August, 1927.

News of the Industry

C., M. & St. P. Railroad Electrified to Seattle

Piloting a 260-ton electric locomotive over a 10-mile extension of the Chicago, Milwaukee & St. Paul Railroad's electrified lines, Mayor Bertha K. Landes of Seattle recently brought the first electrically operated train from Black River Junction into the terminal station in the metropolis of Washington State. Formerly it had been necessary to change to a steam-driven locomotive at the Junction. All trains, including the two through passenger trains, the Olympian and Columbian, as well as the Rainier Park Special between Seattle and Tacoma, are now drawn by General Electric 260-ton gearless electric locomotives into either Tacoma or Seattle.

This extension brings the total electrification of the St. Paul road to 655 miles. It extends from Harlowton, Mont., to Avery, Idaho, a distance of 440 miles, and from Othello, Wash., to Seattle and Tacoma, a distance of 215 miles. Five mountain ranges are crossed.

Regional Meetings of A.I.E.E. for 1927-28 Approved

Exclusive of the Pacific Coast convention of the American Institute of Electrical Engineers at Del Monte, Sept. 13-16 (approved last year), four regional meetings have been indorsed by the board of directors of the Institute. These will be held by the Great Lakes, Northeastern, Northwestern and Southern districts respectively. The Great Lakes meeting will be held in Chicago on Nov. 28-30 this year, the Northeastern in the spring of 1928, the Northwestern (Pacific Coast) probably in September, 1928, and the Southern also in the fall of next year. The annual winter convention of the Institute will, as usual, be held in New York in February, and the annual summer convention, as previously announced, in Denver in the week beginning Monday, June 25.

Outlook for Power Exportation from Maine Better

As previously intimated in the ELECTRICAL WORLD, plans are rapidly developing toward the establishment of a policy between Maine, New Hampshire and Massachusetts under which surplus hydro-electric energy may be exported from the Pine Tree State if suitable legislation can be passed next winter. It is anticipated that a draft of a compact providing for the transmission of such surplus energy under the regulative powers of the interested state public utility commissions will be presented at the next meeting of the New England Council, scheduled for Poland Springs, Me., Sept. 16 and 17. If the power companies accept this plan, which now appears probable, and if the state representatives concerned agree upon it, Governor Brewster will probably call a special session of the Maine Legislature in January, 1928, to ratify the compact.

The outlook for the modification of the Fernald non-exportation law is now better than at any time since its enactment about eighteen years ago. At the last session of the Maine Legislature a bill to permit water-power exportation failed to pass by only a narrow margin. It is estimated that $500,000 worth of surplus hydro-electric energy will run to waste this year in Maine as a result of the continuance of the Fernald act, and President Walter S. Wyman of the Central Maine Power Company thinks that within the next ten years $40,000,000 will be invested in Maine water-power development if exportation is permitted.

Contract for Saluda Plant Is Signed with Arundel

Contract for construction of the superpower hydro-electric project on the Saluda River, in South Carolina, was signed on Aug. 19 between the Barstow interests and the Arundel Corporation of Baltimore, which as predicted some weeks ago, was the successful applicant. Work on the project, which will cost about $20,000,000, will be started early next month and construction will be rushed, it was announced by Joseph J. Hock, president of the Arundel Corporation.

Plans call for the construction of an earth fill in the river, about 10 miles north of Columbia, to provide a reservoir with a shore line of more than 400 miles. Columbia and other cities will be supplied with power from the plant, which will have an ultimate generating capacity of not less than 200,000 hp. and rank with the biggest of its kind.

Baltimore Company Wins Havre de Grace

In Granting Consolidated Gas, Electric Light & Power Right to Serve That City the Maryland Commission Rules Against Philadelphia-Controlled Rival

RIGHT to retain its power lines in Havre de Grace, Md., and serve that city was granted on Tuesday of this week by the Maryland Public Service Commission to the Consolidated Gas, Electric Light & Power Company of Baltimore after a hearing lasting intermittently from Aug. 4 to Aug. 19. The only explanation given for the action was that the Baltimore company's service was "necessary and convenient for the public service." Many residents of Havre de Grace testified before the commission that the service rendered by the Northern Maryland Company was unsatisfactory and inadequate and that the Baltimore company supplied satisfactory service to the town. Francis J. Carey, counsel for the Northern Maryland Power Company, which has been protesting the right of its rival to serve Havre de Grace, said that "it may be assumed" an appeal will be taken to the courts.

As a result of the hearings it was definitely established that the fight for the territory lay between the Baltimore company and the Philadelphia Electric Company, promoter of the Conowingo project, whose great dam is only 12 miles from Havre de Grace. This was disclosed when John H. Ware, president of the Northern Maryland Power Company, produced a contract, dated July 28, that showed the Philadelphia company to have control of the Northern Maryland company by stock ownership. Formation of the Susquehanna Utility Company to control the Northern Maryland Power and also by stock purchase the Southern Pennsylvania Power Company, in both of which Mr. Ware had been the chief factor, is noted under "Purchases and Mortgages," on another page.

Proceedings now pending in the Circuit Court for Harford County will decide whether the Northern Maryland company can retain its lines in Havre de Grace despite an ouster ordinance passed by the City Council. The Public Service Commission claims no jurisdiction in the matter.

The order approving the construction of the Baltimore company's lines into Havre de Grace also included approval of construction of the Gould Street power plant in Baltimore. Although the plant has been completed, application for its construction had not been made to the commission. Certain transmission-line routes in the disputed territory were apportioned by the commission between the Baltimore company and the Conowingo Electric Light & Power Company, a Philadelphia Electric subsidiary.

Westinghouse Gets Order for 1,200-lb. Pressure Unit

The Kansas City Power & Light Company has just ordered from the Westinghouse Electric & Manufacturing Company for installation in its Northeast station at Kansas City a 10,000-kw. turbo-generator unit to operate at 80 per cent power factor. The turbine end of the new unit will

be designed to operate with 1,200 lb. gage steam pressure and 725 deg. F. total temperature at the throttle and will exhaust at 300 lb. gage pressure.

The generator, which is direct-connected to the turbine, will be rated at 12,500 kva. unity power factor, producing three-phase, 60-cycle current at a potential of 13,200 volts. A direct-connected exciter will be furnished. The combined unit will operate at a speed of 3,600 r.p.m.

Transmission in New York

Upstate Facilities Increased by Niagara, Lockport & Ontario and Empire Gas & Electric

THE Niagara, Lockport & Ontario Power Company has completed construction of its new 110,000-volt transmission line across New York State between Mortimer and Syracuse. The company's terminal structure at North Syracuse, where the actual tying in of the lines will take place, is being built and will be ready for service this fall. This is the longest transmission line built by the company in recent years. It extends 88 miles across the state, leading out of Mortimer switchnig station, on the outskirts of Rochester. Eleven miles of this distance, between Mortimer and Fairport, has three-circuit towers carrying nine cables. Two of the circuits are insulated for 110,000 volts and the remaining circuit for 60,000 volts. From Fairport to North Syracuse the line is composed of two-circuit towers carrying six cables insulated for 110,000 volts.

The new line furnishes two additional power paths to Syracuse. At the terminal station in North Syracuse the lines from the west will tie in with those from the company's Salmon River plant as well as with the lines of the Adirondack Power & Light Company for an exchange of power with the Niagara system. The Syracuse Lighting Company also will obtain a considerable part of its power supply from the new transmission lines.

Another addition to New York's power transmission facilities will come with the completion early in September by the Empire Gas & Electric Company of Geneva of a transforming station at Border City, Seneca County. The generating plant of the Empire Coke Company, a subsidiary, at Border City is being remodeled, and from it will be distributed electricity for Geneva, Auburn, Seneca Falls, Waterloo, Lyons, Palmyra, Newark, Clifton Springs, Phelps, Penn Yan and intermediate points. Power from Niagara Falls, Waterloo, Seneca Falls and auxiliary generating plants will be received at this station for distribution at 33,000 volts, and the Auburn station will be discontinued.

Expansion Plans of San Joaquin Light & Power

With the approval of estimates for the building of a 110,000-volt steel-pole transmission line between the Rio Bravo substation and the Bakersfield steam plant, to cost more than $130,000, the San Joaquin Light & Power Corporation will begin another step in a development program in which $536,000 will be expended in increasing the capacity of substations and transmission lines in the Kern County territory, according to D. L. Wishon, district manager for the company in Bakersfield. This program, which covers two years, provides for the construction of 30 miles of high-voltage line, increasing the capacities of four substations to meet the steadily growing demand for power in both agricultural and oil districts, and for the installation of voltage-control apparatus for the improvement of operating conditions.

The line from Rio Bravo to the Bakersfield steam plant will be the completing link in a loop joining the Bakersfield steam plant with the Midway steam plant, the southern distribution center for the main trunk of the power system extending through the heart of the San Joaquin Valley. This loop will strengthen the reserves of both the Midway and the Bakersfield territory and provide additional feeders into the Rio Bravo substation and Kern Oil substation. The largest single item in the program of improvements is the addition of four 10,000-kw. transformers and a 20,000-kw. synchronous condenser at the Kern Oil substation, to cost approximately $330,000. Part of the program was completed by the installation several weeks ago at the Weed Patch substation of four 3,000-kva. transformers, increasing the plant capacity to approximately 12,000 hp.

Cost of Auxiliary Steam Plant for Toronto

Interesting figures on the cost of the steam plant that it is proposed to build in the city of Toronto to augment the energy it now receives from Niagara Falls through the Ontario Hydro-Electric System, with which the Toronto Hydro-Electric System is closely connected, are contained in a report made to the last-named organization by McClellan & Junkersfeld of New York. They are for an initial installation of 70,000 kw. and an increased rating of 150,000 kw. and are given in the accompanying table. The peak demand for energy of the Toronto Hydro-Electric System in 1926 was 220,675 hp., which was supplied exclusively by the Ontario system. Estimate is made that in twelve years' time, when population is expected to grow from 635,000 to 860,000, the peak load will increase to 686,500 hp., and the New York engineers, as a result of their study, think that the proposed auxiliary steam plant for peak power in conjunction with hydro-electric service will furnish energy at a lower total cost to the city of Toronto than Hydro power entirely and in addition will provide standby reserve for emergency.

PRELIMI. \RY ESTIMATES OF COST OF TORONTO AUXILIARY STEAM-ELECTRIC GENERATING STATION

	Installed Capacity First Section 70,000 Kw.	Two Sections 150,000 Kw.
Land (9 acres), intakes buildings, foundations and condensing-water system, station yard and tracks, machinery foundations, and coal dock and coal handling machinery	$2,629,000	$4 962,000
Boiler and fuel-burning equipment and draft system	1,190,000	2,320,000
Feed-water system and piping	595,000	1,075,000
Turbines, generators, condensers and auxiliaries	1,470,000	2,900,000
Auxiliary equipment and service equipment	368,000	700,000
Switchboard conduit and wiring	420,000	825,000
Preliminary operation	28,000	50,000
Total	$6,700,000	$12,832,000
Cost per kilowatt of installed capacity	$95.71	$85.54

No Rate Increases Intended

Massachusetts Companies Do Not Contemplate Them if Supreme Court Finds for Worcester Company

BECAUSE of the appeal of the Worcester Electric Light Company to the United States District Court against the enforcement of the order of the Department of Public Utilities to reduce rates charged for domestic lighting from 7 cents to 5 cents per kilowatt-hour question has been raised concerning the effect a decision for the company will have if it is upheld by the United States Supreme Court. Some newspapers have already voiced the opinion that it will result in higher rates for both electricity and gas. On behalf of the utility companies in the state the New England Bureau of Public Service Information has issued a statement signed by S. T. MacQuarrie, director, which includes the following paragraphs:

"The companies engaged in selling gas and electricity in Massachusetts have no intention of raising rates no matter what the decision of the Supreme Court may be. It has been their consistent policy for years to reduce the maximum rates charged for their service as fast as that could be done with safety. This policy is not altruistic but is based on sound business principles. How long this policy can continue no one can tell. Another war might raise the level of all prices, so that electric and gas rates might have to be raised, but that is a contingency which would have to be considered at that time and is not pertinent to the case in hand. The past record of Massachusetts gas and electric companies in consistently and voluntarily reducing their rates as conditions warranted is the best guide as to their future conduct.

"There is no hard and fast rule as to rates which can be followed, because of the varying character of the service demanded by the public of the different companies. A 12-cent rate for one company may be just as reasonable as a 7-cent rate for another. Forced reductions of rates at a time when the reduction cannot be made with safety are a mistake and result ultimately in loss to the public. Proper reductions, on the other hand, lead to greater business without endangering the safety of the money which the investing public has placed in these public utility companies and result in greater good to the public."

Purchases and Mergers

Susquehanna Utility Company Organized to Control Northern Maryland and Southern Pennsylvania

ACCORDING to testimony before the Maryland Public Utility Commission, the Susquehanna Utility Company is, at the instance of the Philadelphia Electric Company, to be incorporated in Delaware for the purpose of acquiring electric properties now operating in southeastern Pennsylvania and the northern part of Maryland. The Susquehanna Utility Company will acquire the capital stock of the Eastern Power Company, a holding company which controls the Northern Maryland Power Company and the Southern Pennsylvania Power Company. Both companies operate in the territory adjoining and adjacent to Conowingo. An official of the Philadelphia Electric Company is quoted as saying that the Susquehanna company was being formed to buy stocks of other electric companies, but that its formation had nothing to do with the Conowingo development. The Northern Maryland and Southern Pennsylvania concerns have combined assets of more than $2,000,000. They have been owned principally by John H. Ware, Jr., who testified before the commission.

Stockholders of the Pennsylvania Water & Power Company have ratified the proposal to merge with the Holtwood Power Company, and the approval of the Holtwood stockholders has also been given.

A special election will be held Sept. 15 on a proposal to sell the municipal distribution system at Roland, Iowa, to the Iowa Railway & Light Corporation for $25,000 and grant a 25-year franchise to the company. The sale is to include the 6,600-volt transmission line between Roland and Story City.

A petition from the Kentucky-Tennessee Light & Power Company to purchase the city plant at Gallatin, Tenn., is before the Tennessee Railroad and Public Utilities Commission. The price is said to be $110,000.

The Federal Public Utilities Company, a Mississippi corporation with offices in Chicago, has become the owner of the Waynesboro (Miss.) Ice & Light Company.

The Benton Counties Utilities Corporation of Gentry, Ark., subsidiary of the Empire District Electric Company, has renewed an offer to buy the municipal lighting plant at Gravette. The offer is $20,000 for the lighting system and $35,000 for both water and light systems.

The Missouri Power & Light Company has purchased the Powersville (Mo.) light plant from the local owners.

The Shawinigan Water & Power Company, through its subsidiary, the Beauharnois Electric Company, has purchased the Valleyfield Electric Company from Montreal Cottons, Limited, for a price not stated. The Valleyfield Electric, with 6,000 customers, is a distribution system through which Montreal Cottons has been supplying Valleyfield and adjacent municipalities with power from the textile company's own development. It now becomes part of Beauharnois Electric and will derive power from the plant at St. Timothee operated by the Canadian Light & Power Company, another Shawinigan subsidiary.

Projects Before the Federal Power Commission

B. G. Slining of Chicago has applied to the Federal Power Commission for a preliminary permit covering a project on the Big South Fork of the Cumberland River near the Kentucky-Tennessee line. He proposes to erect a dam 375 ft. high and to install 80,000 kva. The application is in direct conflict with that of Edward Allen, also of Chicago, and with the application of H. A. Spaulding for a smaller project which would be flooded out by either of the other proposed projects. The Spaulding project contemplates the utilization of a nearby site on the Obed River and another on the Obey River. The commission already has taken jurisdiction over the Cumberland site as a result of action on a declaration of intention filed by Mr. Spaulding.

John R. Maurstad of Killisnoo, Alaska, has applied for a license covering a 400-hp. project at the outlet of Hidden Falls Lake on Baranoff Island. The power is to be used to operate a sawmill.

The commission has been asked not to approve the design of the Diablo Dam of the city of Seattle in its present form. Certain structural changes have been decided upon by the engineers planning the Skagit River development.

A project already briefly listed and for which the Public Service Company of Colorado seeks a preliminary permit affects the Royal Gorge on the Arkansas River, near Canon City, Col. Here it is proposed to construct a diversion dam creating a pond of 529 acre-feet capacity from which water will be conducted through a conduit and tunnel to a forebay of 193 acre-feet capacity, thence through a penstock to a power house which will have an installed capacity of 33,000 hp. The power is designed for public utility purposes.

In the Cascade Power Company's application for a preliminary permit to construct a low crib dam on May Creek and Lake Isabel, partly within the Snoqualmie National Forest, Washington State, it is proposed to raise the level of the lake 20 ft. and to tap the lake 80 ft. below the present surface. A steel penstock 9,000 ft. long will be built, and 10,000 hp. will be the installed capacity of a power house built to serve public utility companies and municipalities.

Municipal Electricians Meet at Salt Lake City

Approximately 300 delegates, representing many cities in the United States and Canada, were in attendance at the thirty-second annual convention of the International Association of Municipal Electricians, held at the Hotel Utah, in Salt Lake City, Aug. 16 to 19. One of the features of the convention was the display of more than $50,000 worth of equipment in traffic signals, police and fire alarms, street lamps, airplane landing-field lights and signals. All of this equipment was of the latest design, and all principal manufacturers were represented.

The opening session on the first day was devoted to a program of welcome and getting acquainted. The general subject for the afternoon session was "Electrical Inspection." S. W. Borden of Newark, N. J., discussed "Safety Circuits"; W. J. Canada of New York, field secretary of the National Fire Protection Association, had as his subject "The Inspector," while William S. Boyd of Chicago, secretary of the Western Section, International Association of Electrical Inspectors, chose as his theme "The Sirdar" and A. Penn Denton of Kansas City spoke on "The

"Thomas Jefferson Searchlight" Seen at Great Distances

REPORTS sent to the Mayor of Charlottesville, Va., concerning the illumination by a gigantic spotlight of Monticello, the home of Thomas Jefferson, as noted last week, indicate that the 1,380,000,000-cp. beam was seen for great distances, the furthest report being from Reidsville, N. C., 160 miles away. Accounts of its visibility came from Lynchburg, Danville, Fredericksburg, Roanoke, Staunton and other Virginia points.

National Electrical Code as a Bond Between the City Electrician and the Electrical Contractor."

Speakers at the second day's sessions and their subjects were as follows: T. C. O'Hearn, Cambridge, Mass., "Municipal Fire-Alarm Systems"; Robert J. Gaskill, Fort Wayne, Ind., "Rectified Alternating Current with Floating Battery in Fire and Police Signal Service"; F. M. Clements, San Francisco, "The Phantom Box"; W. J. Smith, New York, "Interior Fire-Alarm Systems," and P. S. Harvey, Philadelphia Storage Battery Company, "Fire-Alarm Battery Developments." Addresses by Basil F. Howard, Denver, and E. E. Salisbury, San Francisco, were also made.

The third day's sessions were devoted to the discussion of traffic control, municipal plants and street lighting. Traffic control was the theme of talks by J. G. Regan, traffic control specialist; F. H. Winkley, General Electric Company, Schenectady, N. Y., and K. W. Mackall, Crouse-Hinds Company, Syracuse, N. Y. E. F. Scattergood, chief electrical engineer Bureau of Power and Light, Los Angeles, had as his subject "The Advantages of Municipally Owned and Operated Electric Systems"; "Lighting Main Traffic Arteries," was the subject of an address by A. F. Dickerson, General Electric Company, and L. A. S. Wood, Westinghouse company, spoke on "Street Lighting and the Municipality."

Officers elected for the coming year are: President, David Reed, Denver; first vice-president, Charles K. Ahern, Waterbury; second vice-president, George Allen, Jacksonville, Fla.; third vice-president, Chester L. Lynch, Seattle; fourth vice-president, B. C. Holdaman, Kansas City; secretary, H. N. Lang, Orlando, Fla.; treasurer, W. A. Dilzell, New Orleans (re-elected).

New Orleans was chosen as the 1928 convention city.

Potomac Project Defended Against Critics

Promoters Think that the Scenery Argument Is Not All on One Side—Executive Secretary Merrill Sheds Light on the Flathead Lake Application

BENEFITS which will follow from the development of power on the Potomac River in the Washington area outweigh the reasons advanced for leaving the river as it is, according to arguments presented by representatives of the Potomac River Corporation at a hearing before the district engineer in Washington on Aug. 23. Owing to the extended period during which the waters of the Potomac are low, it is argued that its scenic features would be improved rather than injured by the proposed development. In a brief signed by Robert J. Bulkley, president of the corporation, and Newton D. Baker, former Secretary of War and first chairman of the Federal Power Commission, the following rejoinder was made to the contentions of the National Capital Park and Planning Commission and others that the company's plans would, if carried out, destroy the natural beauty of the site:

"Extreme low flow creates all along the Potomac unsightly and unsanitary conditions fully as objectionable as those due to floods, and such conditions generally exist during the summer and early fall months, the period devoted by people of moderate means to vacations and outdoor recreation. From the standpoint of park construction and maintenance and of recreation, these conditions of extreme high and very low flow cannot possibly be desirable. Some reduction of flood violence and some addition to the nearly stagnant summer river would both be improvements. Our proposal is to equalize the flow of the Potomac as far as now appears to be commercially feasible.

"The effect of storage on floods is sure to be beneficial and may prove to be of vital consequence. Its effect on the river and on Great Falls will be most helpful during periods of prolonged low water, when at every point below the confluence of the South Branch of the Potomac the discharge will be increased from the extremely small natural flow to an amount reasonably adequate for satisfactory scenic and sanitary conditions.

"We question whether the Park and Planning Commission has given adequate thought to the low-water condition above outlined. In any event, we feel that the sanitary benefits our project will undoubtedly bring to the people of the Potomac Valley above Great Falls and its effect in helping to moderate great floods are fully as important as the preservation unchanged of existing conditions for the purpose of creating a park which might be regarded by the average citizen as in no degree superior to such a park as might exist side by side with our power development.

"During a large portion of every year the Potomac at and below Great Falls discharges a puny trickle through a mass of dark, damp and depressing-looking rocks. At such times neither the falls nor the rapids contribute to the enjoyment as much as would the quiet waters of an ample and well supplied lake, one whose level is held practically constant at all seasons of the year. It is not a fact that Great Falls would be done away with. During all periods when the natural flow, as modified by our reservoirs, would exceed 6,000 cu. ft. per second water would discharge over the Great Falls. With moderate or high river stages the discharge over the Great Falls would be little different from its present state. We believe that the creation of a fine lake, with forms of outdoor recreation, would amply compensate for the losses to which the Park and Planning Commission refers.

"The situation of Washington and the character of its population are such that the city is not in line to be industrialized, and the applicants have no intention to adopt any plan to market energy that would injure Washington. On the contrary, the availability of a considerable quantity of hydro-electric energy will tend to obviate the necessity for fuel combustion in providing the power which Washington must have."

O. C. Merrill Explains Flathead River Situation

Some of the objections to the proposed development of power at the Polson site on the Flathead River within the Flathead Indian Reservation in Montana have been raised without full knowledge of the facts, O. C. Merrill, the executive secretary of the Federal Power Commission, believes. In a letter to Mrs. H. A. Atwood, of Riverside, Cal., chairman of the General Federation of Women's Clubs, he says:

"The power plant proposed to be built by the government would make use of the existing Newell tunnel and would have a maximum capacity of 7,500 hp. It is understood, however, that reports recently made to the Indian Service indicate that a continuous output of about 15,000 hp. could be developed from the natural flow of the Flathead River by enlarging the existing Newell tunnel to about twice its present capacity and contain recommendations that an installation of 20,000 hp. be made. The construction of a plant of 7,500 hp. or even of 20,000 hp. would prevent the complete development of the site, which is capable of producing approximately 100,000 hp. Under these circumstances, the Rocky Mountain Power Company, a subsidiary of the Montana Power Company, made a proposal for a complete development.

"Under its offer the company agreed (1) to reimburse the United States for the amount heretofore expended on the Newell tunnel, not to exceed $102,000; (2) to deliver at the power-plant switchboard exclusively for pumping water for irrigation sufficient power for all the government's requirements up to a maximum of 10,000 hp. at a price of 1 mill per kilowatt-hour; (3) to deliver at the power plant or any convenient place on the project such amount of power as may be required for the project and for farm users up to 5,000 hp. at 2½ mills per kilowatt-hour, and (4) to pay annually an amount equivalent to $1 per average horsepower generated at the proposed Polson site and at any other plant the company might build on the Flathead River on reservation lands . . .

"It is not likely that energy could be produced in the proposed government plant at a cost of less than one cent per kilowatt-hour, or ten times as much as the price offered for pumping power and four times as much as the price offered for power for farm use. I personally doubt whether the company can produce the energy at the price it offers, but if it can, it will only be because of the cheaper cost of production in large units and the fact that the character of the load of the Montana Power Company is such that it can utilize a percentage of the maximum output from two to three times greater than would be possible with a farm and pumping load alone."

Move for Union of Electrical Inspectors' Associations

The movement for uniting under one parent body the four electrical inspectors' associations now existing in the United States—the Eastern Association of Electrical Inspectors, originally confined to western New England, but now embracing the whole north Atlantic Coast; the Western Section, International Association of Electrical Inspectors, which succeeded the Western Association of Electrical Inspectors, and two associations on the Pacific Coast—will receive impetus at the annual convention of the body first named, to be held at Springfield, Mass., on Oct. 12 and 13. At this meeting a report from a committee appointed in response to an invitation from the Western association to confer on an acceptable plan of union will be discussed. The Western association itself, which has already helped to set up an international organization, will convene at Toronto, Canada, on Sept. 27-29. This association plans to divide the country into four sections—Western, Eastern, Southern and Pacific, with subordinate chapters in each state. Two chapters are now in existence—Illinois and Wisconsin.

New England N. E. L. A. Will Have Live Convention

Plans are rapidly maturing for the nineteenth annual convention of the New England Division, N.E.L.A., at the Hotel Griswold, New London, Conn., Sept. 12-15, under President W. P. Schwabe. This year business sessions will be held morning and evening only. The program so far as completed follows:

MONDAY, SEPT. 12

Evening.—First General Session: Address, President W. P. Schwabe; report of secretary, Miss O. A. Bursiel; address, H. T. Sands, president N.E.L.A.; address, Paul S. Clapp, managing director N.E.L.A.; educational committee report, E. S. Mansfield; relation of electricity to agriculture, F. A. Belden; rural electric service, F. W. Randall; taxation, Bowen Tufts; address, W. S. Vivian, director of public relations Middle West Utilities Company.

TUESDAY, SEPT. 13

Morning. — Parallel Sessions. — Accounting: Report of chairman, C. J. Allen; statistical committee, John A. Allen; purchasing and stores, J. M. Stuart; stub accounting in customers' records, F. W. Crowley; accounting short cuts, P. M. Scott, Women's Committee; Chairman, Miss A. M. Baker; welcome to Connecticut, Margaret Chagnot; progress, Isabell Davie, national secretary; songs, Olive Russell; "Along the Women's Committee Trail," Mary E. Lehan; "A Woman of Ambition in a Public Utility," Florence G. Chisholm; address, Anna Steese Richardson, *Woman's Home Companion.*

Evening.—Public Relations Session, S. T. MacQuarrie chairman: Address, Representative Charles A. Eaton, Plainfield, N. J.

WEDNESDAY, SEPT. 14

Morning.—Parallel Sessions. Commercial Section, L. A. Fiorani chairman: Address, Earl Whitehorne, commercial editor ELECTRICAL WORLD; address, H. W. Derry, chairman competitive power committee, N.E.L.A., Cincinnati; "Developing New Markets for Power," F. Stuart Fitzpatrick, United States Chamber of Commerce, Washington; "Traffic Signals," J. G. Regan, General Electric Company. Engineering Section, T. H. Haines chairman: Chairman's address; "Progress in Accident Prevention," A. A. Packard; greetings by E. C. Stone, national chairman; "Headquarters Staff Investigations," Major H. S. Bennion, director of engineering, N.E.L.A.; "What the New England Council Expects of the Utility Engineer," speaker to be announced; "A Message to Engineers from an Executive," speaker to be announced; "Research," L. A. Hawkins, General Electric Company.

THURSDAY, SEPT. 15

Morning. — Accounting and Commercial Joint Session: "The Accountant's Place in Our Industry," C. L. Edgar, president Boston Edison company; address, speaker to be announced.

Texas Plan Denounced

Insull Interests May Withdraw Support of Syndicate Power's Proposed Dams on Colorado

AT A MEETING held in Abilene, Tex., recently of representatives of more than fifty towns situated on the Colorado River and its tributaries resolutions were unanimously adopted protesting against the action of the State Board of Water Engineers in granting water-power rights on the Colorado River to the Syndicate Power Company of Dallas, which is associated with the Insull interests of Chicago. These rights are the basis of the project of the Syndicate company, described in prior issues, to construct a series of six dams and hydro-electric plants at an estimated cost of approximately $15,000,000. The protests had their origin in the belief that the exercise of the water-power rights by the Syndicate Power Company would cause a shortage of water for irrigation and domestic purposes along the courses of these streams. A rehearing of the application of the company for these rights was asked, and it was urged that permits granted in the future expressly subordinate water power to the domestic use of water.

As a result of the sentiment expressed at this meeting it is regarded as probable that the Syndicate Power Company will abandon its project of constructing dams and hydro-electric plants on the Colorado River. Dempster MacMurphy of Chicago, representing the Middle West Utilities Company, who attended the meeting, issued the following statement:

"The Middle West Utilities Company and its operating subsidiaries—the so-called 'Insull interests'—have extensive investments in the State of Texas. These interests expect to develop and increase their properties. They do not desire to engage in any character of development that is not for the best interest of Texas. Their present investments show their faith in the state. As to developing water power on the Colorado River, the Insull interests have no direct or indirect interest in the Syndicate Power Company. They have contracted with the Syndicate Power Company, under certain conditions, to make hydro-electric developments on the Colorado River. This contract on the part of the Middle West Utilities Company was made in view of the existing laws of Texas. The developments were believed to be for the best interests of the state. If it should prove for the best interest of Texas that power rights on the Colorado River be not developed, but that the flow of the river or the floodwaters should be conserved for irrigation and for watering cities along that stream and along the river's watershed, the Insull interests would not be disposed to press the development of the water rights."

Cambridge Company Proposes Two-Part Rate

President J. Henry Russell of the Cambridge Electric Light Company has written to the Massachusetts Department of Public Utilities suggesting that one of three two-part rates which have been designed for this utility be considered by the commission in reaching its finding in the pending petition for reduction of rates to residential consumers. In his communication to the board Mr. Russell states that after the overheads have been covered it is advantageous both to the company and to its customers that energy be sold at rates which will encourage extended use of service through a single meter. An investigation made for the company has led to its recommendation that the following rate be applied:

Service charge, 60 cents per month for the first two rooms plus 10 cents per month for each additional room, plus an energy charge of 3 cents per kilowatt-hour.

The following alternative rates are suggested by the company for the board's consideration in case the above preferred rate is not approved:

Service charge, 95 cents per month plus an energy charge of 3.5 cents per kilowatt-hour, or, service charge, 80 cents per month plus an energy charge of 4 cents per kilowatt-hour.

For commercial lighting the company suggests a rate beginning at 8 cents per kilowatt-hour. for the first 100 kw.-hr. per month, with blocks decreasing to 4 cents for all energy in excess of 5,000 kw.-hr. per month; minimum charge, $1.

It is anticipated that the finding of the commission in this case will be rendered early in the fall.

High-Pressure Wood-Burning Plant in New Mexico

Arthur Prager, manager Albuquerque Gas & Electric Company, has just announced that the company's new power plant at Bernalillo, N. M., in the White Pine Lumber Company's yard, is virtually completed and was tested on Aug. 10. The plant, he says, is the only modern high-pressure steam plant operating in the United States using wood refuse for fuel. There are other steam plants which burn wood refuse, but not at high pressure. This plant is equipped for burning either wood refuse or coal. It consists of a 4,000-hp. Westinghouse steam turbine, exciter and condenser equipment, and a Springfield high-pressure boiler having sufficient capacity to operate the steam turbine and auxiliaries. This boiler operates at 400 lb. pressure. The plant utilizes the water of the White Pine Lumber Company's log pond for condensing purposes and has installed modern equipment for treating it.

This new power-plant installation is connected with the Aubuquerque plant, which has a capacity of 5,000 hp., so that the plants can be run in parallel. They are connected by a switching system and transmission line. Doubling the capacity of the Albuquerque Gas & Electric Company's generating plants insures ample capacity for a number of years to come. The present installation represents a new investment of $450,000.

To Probe Rates for Energy in Kansas

That 80 per cent of the electric light and power business in Kansas is in the hands of four companies was the finding of J. H. Fletcher, an engineer employed to report to the Kansas Public Service Commission on rates for residence lighting in the different cities of the state. These companies are listed as the Studebaker-Insull group, owning the Kansas Power & Light Company and the United Power & Light Corporation; the Electric Bond & Share Company, owning the Kansas Gas & Electric Company; the National Electric Power Company, which owns the Kansas Electric Power Company, and the Inland Power & Light Corporation, which owns the Kansas Power Company. In addition there are the Kansas City Power & Light Company, which operates in a limited territory around Kansas City, Kan., and the Empire District Electric Company, a Doherty subsidiary which operates in southeastern Kansas.

The rate schedules attached to the report show a wide variation in the territory of each of the different companies, except in the case of the Kansas Gas & Electric, which has an average rate that applies to every consumer of an equal amount of electricity. These variations will be the subject of the investigation which it is expected the commission will order for late in September or early in October, when it will ask the companies to justify the variations. Power rates will not be a subject of the investigation, as these are now under a sliding scale, fixed according to the cost of coal and other operating items.

Surveys Prepare Way for Cowlitz River Plant

Preliminary plans for the construction of the ten-million-dollar hydro-electric power plant of the Grays Harbor Railway & Light Company of Aberdeen, Wash., are progressing rapidly, according to W. W. Briggs, vice-president and general manager of the company. The plant is to be built on the Cowlitz River at Mossy Rock. The survey crew has already proved the first dam site at Mayfield and is now working on the location of a storage basin to augment the water supply for the main plant. It is expected that the Mossy Rock survey will be completed during the summer months and surveying started at a third dam site for the second storage basin.

The development of a power plant by the Backus-Brooks interests on the Cowlitz will be subject to the approval of the Grays Harbor Railway & Light Company, Mr. Briggs said. "We own the land along the river and have the right of eminent domain," he asserted. "The Supreme Court has ruled that there could be no condemnation of our property to permit another company to make the same kind of a development as we plan. Furthermore, the Backus-Brooks company contemplates the granting of power for private use, while ours would fall under the public utility plan. This gives us increased rights."

Briefer News

Russia Manufactures 10,000-Kw. Unit.—A 10,000-kw. turbo-generator, constructed in Leningrad, has been installed in the Petrovsky steel mill at Dniepropetovsk, Soviet Russia. This is declared to be the largest turbine ever manufactured in Russia. The Leningrad plant will make for the Electrotok Trust two 22,000-kw. turbo-generators.

Virginia and North Carolina Have New 132-Kv. Line.—The 132-kv. line of the Appalachian Power Company running from near Roanoke, Va., past Danville and interconnected with the lines of the Carolina Power & Light Company extending from Roxboro, N. C., has been energized, supplying a new high-tension interstate line in that region.

Wyoming Utility Association Elects Officers.—On Aug. 16 the Wyoming Utility Association met at Cheyenne and elected the following officers: President, J. Keegan, Cheyenne; first vice-president, W. O. Johnson, Casper; second vice-president, E. H. Soule, Laramie; executive committee, H. L. Williams of Evanston, J. J. Withrow of Sheridan and J. H. Jacobucci of Green River.

Missouri Power & Light to Close Gap in Its Interconnected Lines.—Work is to be started at once by the Missouri Power & Light Company on a high-tension line from Macon, Mo., through Atlanta and La Plata, to Kirksville, a distance of 25 or 30 miles, closing the only gap in the company's transmission system in that section of the state, which is tied in with the lines of the Mississippi River Power Company from Keokuk, Iowa.

A British Tidal Power Experiment.—At Exmouth, Devon, England, an "Exe power experiment fund" has recently been formed to carry through a project for the installation of a plant, drawn up by E. L. Fleming, to utilize the tidal power of the River Exe. An experiment is to be tried at the pier at Exmouth to obtain data regarding the utilization of the power of the tides flowing in and out for commercial purposes and for generating electricity.

Kansas City Power & Light Reduces Rates.—A reduced schedule of electric rates has been filed by the Kansas City Power & Light Company and approved by the Missouri Public Service Commission, effective on Sept. 1. The new rates affect Kansas City, North Kansas City and other parts of Jackson County. The reduction is from 7½ cents per kilowatt-hour to 7 cents to residence consumers. Small power consumers who now pay 7½ cents for the first 60 kw.-hr. used per month will pay but 7 cents. Other consumers who pay 6½ cents for the first 60 hours will pay but 6 cents. The reductions will benefit 108,731 customers of the company, and it is estimated that these consumers will save $219,712 in a year.

Byllesby Engineering Department Moves to New Quarters.—The engineering and purchasing departments of the Byllesby Engineering & Management Corporation have just moved into new quarters on the eighth and ninth floors of the Bankers' Building, corner Adams and Clark Streets, Chicago. This building adjoins the Illinois Merchants' Bank Building, where the offices of H. M. Byllesby & Company and other departments of the organization are. Increased space required by the rapid growth of the organization led to the removal.

Pushing Work on St. Regis River Dam.—Work on the dam which the St. Lawrence Valley Power Corporation of Potsdam, N. Y., is building at Whittaker Falls, on the St. Regis River, two miles below Parishville, is progressing rapidly. This dam is of reinforced-concrete type and is about 900 ft. long and 60 ft. high at the highest point. It is expected that the concrete will all be poured early next month. When the dam is completed the power company will have one of the most efficient and modern hydro-electric plants in northern New York.

High-Power Line to Be Carried Through Massachusetts City. — The Turners Falls Power Company has been granted authority to construct a high-power transmission line through the city of Westfield, Mass. The line will cross the city infirmary and four highways and will connect with the Springfield Water Works project at Cobble Mountain. The Westfield City Council reserves the right to revoke permission with a ninety-day notice. Electric power will be furnished companies employed in the construction of a diversion tunnel through Cobble Mountain.

Lawton, Okla., Joins "White Way" Cities. — A spectacular "white way" opening occurred at Lawton, Okla., on Aug. 8 when current was turned into the system of 95 modern single-standard lamps covering 23 city blocks. The expense of installation was borne by the Southwestern Light & Power Company, which supplies Lawton and about 80 other cities and towns in southwestern Oklahoma. Eighty of the lamps are 400-cp. units and have been placed on the three main avenues in the business district, while fifteen standards of 600 cp. each have been placed a little farther apart on the side streets. The installation has aroused interest in other cities, and Chickasha is now considering installing a "white way."

Way Cleared for Development of Savannah River.—With the repeal by the Georgia Legislature of certain old statutes affecting navigation on the Savannah River north of Augusta, the way will be cleared for the hydro-electric development of this important stream. Before the era of railroads stringent laws were enacted to prevent the obstruction of river traffic by dams of any kind. The Zellers bill, which recently passed the House of Representatives, repeals these statutes. One dam across the river is already contemplated, and it is prophesied that in

a few years the hydro-electric power of the Savannah River will be fully developed.

To Test Lignite Coal Under Boilers at Mobridge, S. D.—Erection of a generating plant at Mobridge, S. D., for the use of lignite coal will be started early in September, according to Frank Tracy, manager of the state coal mine at Haynes, N. D. Governor Bulow, chairman of the state coal mining commission in South Dakota, and the other members of the commission, as well as the state engineer, are said to be actively interested in the project. Fuel experts have been asked to design and install a plant which will make it possible to burn the lignite just as it comes from the mine, regardless of its firmness or moisture content, Mr. Tracy declared.

Great Lakes Division Convention Program.—Prominent persons who have promised to address the seventh annual convention of the Great Lakes Division, N.E.L.A., at French Lick, Ind., on Sept. 22-24 include President H. T. Sands and Executive Manager Paul S. Clapp of the National Electric Light Association; J. F. Owens, chairman Public Relations Section, N.E.L.A.; Representative Charles A. Eaton, B. J. Mullaney, vice-president People's Gas Light & Coke Company, Chicago; E. W. Lehmann, professor of farm mechanics, University of Illinois; Charles M. Ripley, General Electric Company; Mrs. Edward Franklin White and Earl Whitehorne. The Great Lakes Division's women's committee will have a separate session on Thursday afternoon, Sept. 22. This will be addressed by leading women.

Nebraska Sticks to Its State Generating Plant. — The Nebraska Board of Control, which has charge of five state institutions in the vicinity of Lincoln, has declined the offer of the Lincoln Public Service Company to enter into a ten-year contract to supply the state with all the electrical energy it may need for 1½ cents per kilowatt-hour. The board claims that with the prison labor available in the state plant at the penitentiary the cost of energy, a by-product from the penitentiary steam laundry, will be substantially below that offered in the contract. The commission in charge of construction of the new state Capitol is to confer with the board of regents of the University of Nebraska on the desirability of constructing a joint plant to be added to the state's resources.

Virginia Electric & Power Company's Expansion Program.—With the completion of the new 30,000-kw. generating unit at the Reeves Avenue station in Norfolk, Va., one of the largest items in the Virginia Electric & Power Company's construction budget is for transmission lines in eastern North Carolina to serve territory in which the company does not now operate. The company is not prepared to make public at this time its North Carolina plans, but $500,000 had been allocated for this work. Construction last year of a transmission line through the Dismal Swamp to Edenton, Hertford and other North Carolina points makes it possible for the company to branch out in that state at relatively small expense for the Dismal Swamp line can transmit energy in far greater volume than its present load.

Interconnection Between Kentucky Utilities System and Mouth-of-Mine Plant.—The Kentucky Utilities Company has arranged to take energy amounting to 3,000 kw. from the Kentucky Electric Power Company of Nortonville, Ky., mine-mouth subsidiary of the Norton Coal Mining Company. "The tying in of this modern generating station," the central-station company announces, "adds to the power sources and further strengthens the power service of the Kentucky Utilities Company. A temporary connection has already been made with the transmission loop which includes the Paducah, Earlington and Graham generating stations in Kentucky and the Grand Tower and Muddy stations of the Central Illinois Public Service Company. The aggregate generating capacity of the plants feeding this loop is 119,000 electrical horsepower."

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see the ELECTRICAL WORLD for July 2, page 50.]

Camp Co-operation VII—Association Island, Henderson Harbor, N. Y., Aug. 28-31. Society for Electrical Development, 420 Lexington Ave., New York.

National Electrical Manufacturers' Association—Policies Division, Association Island, N. Y., Sept. 1-3; Apparatus Division, Briarcliff, N. Y., Oct. 24-27. S. N. Clarkson, 420 Lexington Ave., New York.

Wisconsin Utilities Association, Electric Section—Madison, Wis., Sept. 2 and 3. J. N. Cadby, 432 Broadway, Milwaukee.

Eastern Division, N.E.L.A.—Bedford Springs, Pa., Sept. 7-10. H. A. Buch, 212 Locust St., Harrisburg, Pa.

New England Division, N.E.L.A.—New London, Conn., Sept. 12-15. Miss O. A. Bursiel, 20 Providence St., Boston.

Pennsylvania State Association of Electrical Contractors and Dealers—Lawrence Hotel, Erie, Pa., Sept. 12-14. M. G. Sellers, 1202 Locust St., Philadelphia.

American Institute of Electrical Engineers—Pacific Coast convention, Del Monte, Cal., Sept. 13-16. F. L. Hutchinson, 36 West 39th St., New York.

Empire State Gas and Electric Association—Electric Meter Section, Hotel Syracuse, Syracuse, Sept. 15-16; annual convention, Lake Placid Club, Lake Placid, N. Y., Oct. 6 and 7. C. H. B. Chapin, Grand Central Terminal, New York.

Great Lakes Division, N.E.L.A. — French Lick Springs, Ind., Sept. 22-24. R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

Association of Edison Illuminating Companies—Colorado Springs, Col., Sept. 26-30. P. S. Millar, 80th St. and East End Ave., New York.

International Association of Electrical Inspectors, Western Section—Toronto, Canada, Sept. 27-29. W. S. Boyd, 175 W. Jackson Blvd., Chicago.

American Electric Railway Association—Cleveland, Oct. 3-7. J. W. Welsh, 292 Madison Ave., New York.

Illuminating Engineering Society — Edgewater Beach Hotel, Chicago, Oct. 11-14. L. H. Graves, 29 West 39th St., New York City.

Eastern Association of Electrical Inspectors — Springfield, Mass., Oct. 12-13. E. P. Slack, 85 John St., New York.

Rocky Mountain Division, N.E.L.A.—Broadmoor Hotel, Colorado Springs, Col., Oct. 17-20. O. A. Weller, 900 15th St., Denver.

National Association of Railroad and Utilities Commissioners — Dallas, Tex., Oct. 18-21. James B. Walker, 270 Madison Ave., New York.

Public Utilities Association of West Virginia—Parkersburg, W. Va., Oct. 26-27. A. Bliss McCrum, 514 Charleston National Bank Bldg., Charleston, W. Va.

Ohio Students to Write Essays on Rural Electric Service.—Governor Donahey of Ohio was the first contributor to a fund of $4,500 being collected by C. A. Dyer, legislative agent of the Ohio Farm Bureau Federation and the Ohio State Grange, for distribution as prizes to Ohio high schools and college students for essays on one of the following subjects: "The Advantages of Rural Electrification," "The Farmer's Right to Receive Electric Service," "The Obligation to Pay Fair Electric Rates," "The Electric Company's Obligation to Furnish Rural Service" and "The Electric Company's Right to Receive Fair Rates for Rural Service."

Program of International Congress for Testing Materials.—Subjects to be treated at the International Congress for Testing Materials when it meets at Amsterdam, Sept. 12-17, are divided into three sections, in each of which 27 papers will be presented. These sections are to treat respectively of (1) metals, (2) cement, concrete, stone and bricks, and (3) miscellaneous materials, including oils, rubber and wood. At the general meetings of the congress four papers will be read—"Materials Testing as a Stimulus to Research," by T. D. Lynch of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; "The Rupture of Solids," by A. Mesnager of Paris; "The Problem of the Elastic Limit," by Professor Korber of Dusseldorf, Germany, and "Plastic Deformation and Fracture of Metals," by Dr. Rosenhain of England. There will be three official languages—French, German and English.

New York Edison to Install Huge System-Operating Switchboard. — One of the largest system operators' boards in this country is soon to be installed by the New York Edison Company in a large room, especially built for the purpose, on top of its East Fortieth Street switch house. The new equipment will be of General Electric design, and the main indicating panel will be semi-circular with a 16-ft. radius. The installation is to consist of twenty welded sections of structural steel, each 20½ in. wide. Compound panels are to be mounted on the front of these units. The total height of the structure will be 12 ft. 7 in. Below the metering section will be 2,500 pairs of red and green lamps conveying indications from 300 breakers in the Hell Gate station, 200 breakers in the Sherman Creek station and 100 breakers in the East River station. Breakers on Waterside No. 1, Waterside No. 2 and the switch house will be indicated by a direct-wire connection. This board will also show indications from circuit breakers at the company's main generating stations.

Recent Court Decisions

Merchant Not Responsible for Injury to Customer While Trying to Turn on Light.—In McClusky vs. Duncan a customer sued a storekeeper for injuries attributed to a violent movement following a slight electric shock received when the customer, not knowing how to turn on a ceiling light in a toilet provided for the use of customers, reached up and touched uninsulated wires. The Alabama Supreme Court sustained a verdict for the defendant. (113 So. 250.)*

Failure to Extinguish Fire Near Inflammable Material May Be Negligence.—In a case where employees of an electric light and power utility had lighted a fire on a storage lot in order to burn the insulation from a large quantity of copper wire and where, as alleged, the fire had not been extinguished and had spread to property on an adjacent lot (Young vs. San Joaquin Light & Power Corporation), the California District Court of Appeals sustained judgment for plaintiff, holding that the maintenance of a fire in close proximity to combustible material during the dry season of the year and when the wind is favorable for the spread of the fire may reasonably be held to be negligence. (257 Pac. 152.)

Elements in Finding Rate Base.—One feature of the decision of the United States District Court in the suit brought against the Idaho Public Utilities Commission by the Idaho Power Company (Idaho Power Company vs. Thompson) to upset the rate base fixed by the regulatory body—that annulling certain special rates made by the commission—was noted in this column on Aug. 13 (page 331). A few of the other points made by the court, whose decision was voluminous and went into the whole question of rate fixing, follow: (1) "Reasonable" or "just" return is considered in judicial, as opposed to legislative, aspect and is understood as equivalent to "non-confiscatory." (2) Rate base is computed on fair value of plant at the date of inquiry, according to reproduction cost, adding thereto a reasonable amount for working capital. (3) Contractor's fee of $250,000 paid to plaintiff by itself for two-year construction program is held excessive and rejected on theory that so much thereof as had merit was compensated by reduced material costs. (4) "Going value" is not to be adopted in a broad sense, but all proper elements of actual value must be considered. An element cannot be appraised under the guise of going value which has already been placed under another head. Maintenance, taxes and interest for construction should, as part of going value, be projected beyond the construction period to cover time elapsing before the plant can be brought into service. Expense of advertising and soliciting customers is factor in going value. Franchise and monopoly enjoyed, present economy of operation and company's credit cannot be capitalized as elements in this value. (5) In determining depreciation the question is not whether company's property is worth less than at some other period of its use, but whether as it stands it has the same fair value it would have if new. (6) Court cannot draw on accumulated depreciation reserve to supplement inadequate current income and cannot compensate for past losses out of current income or by giving fictitious value to rate base. (7) Though court will not generally substitute its own judgment for that of the managing officers of a utility company concerning contracts for supervision and special service, this rule is inapplicable where there is common control of both the utility company and the party with whom it contracts. (19 Fed. (2d) 547.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Burden on Company to Prove that an Outsider's Interference with Wire Could Not Be Detected Before Accident.—Owing to the presence of a connecting wire between a conductor and a guy wire a six-year-old boy was severely injured when he came into contact with the latter. On a rehearing of Pine Bluff Company vs. Bobbitt (see ELECTRICAL WORLD for Aug. 29, 1925, page 435), the Supreme Court of Arkansas said that the burden was upon the company to show that the foreign wire was actually placed there by a third party and also that the dangerous condition of the guy wire could not have been detected by the exercise of ordinary care in time to prevent injury. It affirmed judgment for the plaintiff in the original suit (Bobbitt), reducing, however, the damages awarded from $22,500 to $12,500 because of the improved condition of the child. (294 S. W. 1002.)

Obligation to Serve Mines in Receivership Enforced.—A dispute between the Monongahela West Penn Public Service Company and the receivers for the Brady-Warner Coal Company of Fairmont, W. Va., was adjusted in the United States District Court in that state after the institution of contempt proceedings against officers of the utility company, which discontinued service to the mine when the receivers failed to liquidate past indebtedness on the ground that they could not give that company precedence over other creditors or give the surety for the payment of the bill that the company asked. The receivers declared their willingness to meet debts incurred since the receivership began. The power company officials maintained that until they received proper surety for power bills the court was without jurisdiction to compel them to turn on the power and that to do so would be, in effect, confiscation of property. The court criticised the stand taken by the company and ordered that it supply electricity for domestic needs in the mining communities affected and also for the operation of pumps, fans and other safety appliances. An agreement was then reached in conference.

Commission Rulings

Use of Funds to Finance Outside Development Company Censored.—The Tennessee Railroad and Public Utilities Commission has refused to sanction the action of the Tennessee Eastern Electric Company of Johnson City in diverting $250,000 to meet expenditures of the Tennessee Eastern Power Company, a holding corporation not within the commission's jurisdiction, and declared that until the Tennessee Eastern Power Company shall have paid this sum back into the treasury of the Tennessee Eastern Electric Company the commission will not consider the issuance of any further securities by the Tennessee Eastern Electric Company or the payment of dividends on common stock. The commission charged that it authorized the sale of certain securities with the proceeds of which the company was to have made additions and betterments to its property. Instead, the money was used to purchase stock in and convey securities back to the Tennessee Eastern Power Company. In obtaining the reimbursements the electric company shall assume no liability, contingent or otherwise, the commission ordered.

"Active-Room" Lighting Charge in Indiana.—Trial of the "active-room" theory for domestic and commercial electric lighting charges has been found, as already reported under "News of the Industry," to be justified in the Huntington (Ind.) light rate case by an order of the Indiana Public Service Commission, but the commission took occasion to announce that none of its members is in sympathy with the principle. The order authorized the Northern Indiana Power Company to apply the preliminary optional "active-room" schedule of rates in its Huntington district, beginning with meter readings Aug. 15 and continuing in effect until further order or final hearing, which is fixed for Dec. 6. Final hearing on a parallel case in Martinsville, Ind., will be held Nov. 6. While the optional schedules are being tried as experiments in the two cities, members of the commission are making a study of the charge system. In the Huntington order the commission requires the Northern Indiana Power Company to calculate customers' monthly bills under the existing and under the optional schedules, designating charges under each on the statement rendered. The company is required to keep a separate account of the extra expense for making double billings. Patrons, the order says, will have the right to elect whether they shall pay for service under the old or new schedules. Officials of the company had wanted to bill the patron the lower bill, but the commission demands that both bills be given the patron for comparison. It is also provided that the proposed new minimum charge of $1 shall not take the place of the present 50-cent minimum charge during the trial period.

Men of the Industry

J. M. Lee of Chicago Receives Promotion

J. M. Lee, formerly construction engineer with the Public Service Company of Northern Illinois, has been appointed assistant to the vice-president in charge of operations, Julius L. Hecht. As assistant to the vice-president Mr. Lee will be in charge of design and construction. Mr. Lee's affiliation with the Public Service Company dates back to 1910, when he entered its employ in the capacity of fire inspector. In 1911 he became engineer in charge of station No. 5, Oak Park, and in the following year he was made engineer in charge at Blue Island, Joliet and Kankakee. Mr. Lee removed to the general office in 1914 as an assistant in the engineering department, four years later being appointed to the position of assistant mechanical engineer. The year 1922 found him performing the duties of superintendent of electrical production. Some time later he was named construction engineer, the position he held prior to his present appointment.

Carroll Smith, who has been connected with the Consumers Power Company at Grand Rapids, Mich., has been transferred to Saugatuck as local manager of the Southern Michigan Light & Power Company.

R. A. Whitney has been appointed construction engineer of the Public Service Company of Northern Illinois to succeed J. M. Lee, who has recently become assistant to the vice-president in charge of operation. Mr. Whitney has been connected with the Public Service organization since 1915, and has held successively the positions of fuel engineer, assistant engineer, superintendent of electrical production and assistant construction engineer.

W. S. Barstow, head of the W. S. Barstow Management Association, Inc., New York, has been elected president of the Lexington Water Power Company, Lexington, S. C. **J. E. Fredericks** of Columbia, S. C., has been elected a vice-president of that company, and **Lewellyn F. Pearce** and **John W. Weisel**, also of Columbia, have been elected to treasurerships. Messrs. Fredericks, Pearce and Weisel are officers of the Broad River Power Company, which is a subsidiary of the General Gas & Electric Company.

John B. Fisken was the guest of honor at a dinner given Aug. 1 by the officers and heads of departments of the Washington Water Power Company, the occasion marking Mr. Fisken's fortieth year of continuous service in the electrical industry in Spokane. He is now consulting engineer in charge of safety work for the Washington Water Power organization. He operated the first power stations in Spokane in 1887, was in charge of the electrical installation of the Monroe Street station, the first generating plant of importance in the city; constructed many important transmission lines and served as superintendent of light and power and later as chief engineer of the company. A past-president of the Northwest Electric Light and Power Association, Mr. Fisken has always been active in committee work of that body and now holds important committee posts, particularly in regard to safety work.

Dr. C. O. Ruggles, dean of the College of Commerce and Administration of the Ohio State University, has obtained a leave of absence for one year from the university to do special work for the National Electric Light Association.

Owen D. Young, chairman of the board of directors of the General Electric Company, returned from Europe Aug. 23 aboard the White Star liner *Olympic*. While abroad Mr. Young served as chairman of the American delegation to the Stockholm meeting of the International Chamber of Commerce.

J. S. H. Wurtele, vice-president of the Southern Canada Power Company and chief engineer in charge of plants of the Power Corporation of Canada, and **L. C. Jacobs**, engineer in charge of construction of the Power Corporation of Canada, have sailed for France, where they will look over the power situation on behalf of the Foreign Power Securities Corporation.

Jesse Blythe, well known in newspaper advertising circles in St. Louis, has been appointed assistant director of the Missouri Committee on Public Utility Information, St. Louis. Prior to joining the John Ring, Jr., Advertising Company seven years ago, Mr. Blythe was connected with St. Louis daily newspapers in a reportorial capacity. During his association with the advertising agency he handled the municipal advertising campaign inaugurated to bring new industrial organizations to St. Louis.

Franklin C. Eteson, head of the illuminating engineering department of the Virginia Electric & Power Company, has been transferred from Norfolk to Richmond. Prior to joining the Virginia Electric & Power Company organization, Mr. Eteson was sales manager of the Keokuk (Iowa) Electric Company, a property of Stone & Webster, Inc. His transfer to Richmond is in line with the plan of the Virginia Electric & Power Company for a greater development of lighting service to architects, contractors and building interests. Mr. Eteson is a graduate of Brown University, Providence, R. I. His business career began with the Blackstone Valley Gas & Electric Company, in Pawtucket, R. I., and later he joined the sales organization of the Western United Gas & Electric Company of Aurora, Ill. He is a member of the Illuminating Engineering Society. While at Pawtucket Mr. Eteson served as chairman of the lighting committee of the New England Section, N.E.L.A., and was a member of the lighting committee of the national body.

W. E. Brown Appointed District Sales Manager

W. E. Brown, manager of the central-station department of the New York district of the General Electric Company, has been appointed New York district sales manager of the company. Mr. Brown's affiliation with the General Electric Company covers a period of about 28 years, dating back to 1899, the year in which he was graduated from Union College, Schenectady. At first he spent three years in the test course, subsequently entering the industrial engineering department and later the industrial commercial department. He served as local manager of the Schenectady office for eighteen years prior to removing to New York at the close of 1925.

H. C. Hopson, vice-president and treasurer of the Associated Gas & Electric Company, sailed for Europe Aug. 20 on board the *Ile de France*.

A. B. Gochenour, who for the past 30 years has been president of the Chicago Insulated Wire & Manufacturing Company, has been selected to head the Inland Wire & Cable Company, the formation of which was announced in the Aug. 13 issue of the ELECTRICAL WORLD. The new company resulted from the merger of the Chicago Insulated Wire & Manufacturing Company with the Illinois Wire & Cable Company. **George E. Dutton**, formerly president of the Illinois Wire organization, is chairman of the board of directors of the new company.

Obituary

Ambrose P. Merrill, manager of the Salt Lake division of the Utah Power & Light Company, died Aug. 17, after a three months' illness. Mr. Merrill had been a prominent figure in engineering circles in Utah for some time. Prior to becoming division manager at Salt Lake City he served as manager of the company's Ogden division.

Frederick L. Converse, who had been associated with W. B. Coleman & Company, engineers, chemists and metallurgists, Philadelphia, for a number of years, died Aug. 9 after a brief illness. A graduate of Purdue University, Mr. Converse was connected with the steel industry and with the Dupont interests before affiliating himself with the Coleman organization as consultant on engineering problems and power-plant operation.

Fred W. Hild, assistant general manager of the Buffalo Lamp Company, a subsidiary of the General Electric Company, committed suicide at Columbus, Ohio, Aug. 12. Mr. Hild was suffering from a nervous affliction. A native of Terre Haute, he was graduated from the Rose Polytechnic Institute and immediately after graduation joined the National Lamp Works in Cleveland. Following discharge from military service he returned to Cleveland, but was transferred to the Chicago office in 1920, where he remained until last November, when he removed to Buffalo.

Financial and Statistical

Utility Markets Listless
Large Issues Coming
Investment Funds Plentiful

FOLLOWING the action of the security markets in general, utility stocks appear to be waiting for some incentive to create a definite trend. Although less dependent, directly, upon the general movement of business than industrial stocks, these securities are indirectly affected through the influence of business on the markets in general. They therefore share the condition of more or less uncertainty evident during the past few weeks. Although the averages are up slightly this week, there has been no definite movement—just a typical August market. Losses have been about as numerous as gains.

This applies particularly to common stocks, since there has been little activity of any importance elsewhere. Common stocks such as American Gas & Electric and Pacific Gas & Electric have experienced a fairly large volume of buying and have risen accordingly. Electrical equipment stocks have shown several advances.

Among the preferred stocks, as intimated, few have shown any significant changes. Empire Gas & Electric 8 per cent preferred was among the exceptions, showing a substantial gain.

The market for public utility securities is stated to be in a position to absorb large quantities of new issues. Some large issues are in course of preparation and some have been announced for sale during the next few weeks. Investment money is available in large quantities and fall prospects are extremely good. This is reflected by the further recessions in a number of the money rates. Indications are for easy money for some time.

New Capital Issues

Only two substantial electric light and power offerings were made during the week ended Aug. 25. A thirteen-million-dollar issue of first and refunding mortgage gold bonds was offered by the Columbus (Ohio) Railway, Power & Light Company. These 4½ per cent bonds, maturing July 1, 1957, were priced at 93¾ and accrued interest, to yield about 4.90 per cent. They are part of an initial issue of $16,000,000, of which $3,000,000 will be authenticated and placed in the company's treasury. The mortgage securing the bonds is to have a direct first lien on all of the company's electric power and light properties, carried on its books at more than $24,000,000, and a direct lien, subject to $6,704,000 prior lien bonds, on all of its electric railway properties, carried on its books at more than $18,500,000. Proceeds of this issue will be used to retire $10,448,000 outstanding bonds, to reimburse the company for capital additions heretofore made and for other corporate purposes.

The Feather River Power Company made an offering of 7 per cent cumulative class A preferred stock to the amount of $1,000,000, the price being 98 and dividend. The company was incorporated in June, 1925, for the purpose of developing valuable water rights on waterways tributary to the North Fork of the Feather River in Plumas County, Cal. The company is now engaged in the construction of the first of the hydro-electric developments to be undertaken by it in the utilization of these water rights.

The New England Gas & Electric Association made an offering of 5 per cent convertible gold debenture bonds, totaling $17,000,000, the price being 99 and interest, yielding 5.08 per cent. The proceeds from the sale of these bonds will be used for the acquisition or retirement of all bonds and preferred stocks of the operating companies and for the payment of indebtedness or for other purposes of the association.

National Power & Light Company Issues Report

The report of the National Power & Light Company and subsidiaries for twelve months ended June 30 shows net income of $5,641,622 after depreciation, interest, etc., equivalent after dividends on $7 preferred stock to $1.83 a share earned on 2,545,739 no-par shares of common stock. This compares with $4,420,991, or $1.52 a share, on 2,545,815 shares in previous twelve months.

Accounting Treatment of Property Retired

Actual Procedure in Case of a Milwaukee Utility Company Similar to That Accorded Additions and Betterments to Property

By Sam R. Hatch
Milwaukee Electric Railway & Light Company

FOLLOWING the discussion in these columns of the theories on which depreciation is based, Mr. Hatch deals with the actual accounting procedure in connection with the retirement of depreciated property.

ACCOUNTING procedure followed by the Milwaukee Electric Railway & Light Company with respect to the retirement of its property closely parallels that accorded additions to and betterments of its property. When the purchase of any equipment of moment, or new construction, reconstruction or replacement of property, is undertaken, the sanction of the management must first be obtained. Hence the department initiating the purchase or the new work, and under whose direction the purchase is to be made or the work done, issues a requisition, termed a "work order requisition," to bring the matter before the management for its approval. This requisition describes the equipment to be purchased or the nature of the work to be performed, states the reason or necessity therefor and includes an estimate of the cost contemplated. The estimate of cost is detailed and classified according to the company's prescribed classification of accounts, and the requisition further is accompanied by a form provided for the purpose, setting forth the apportionment of the expenditures to be made as between the several utilities composing the company and the various political subdivisions within which it operates.

Upon approval of the work order requisition by the management, the accounting department issues a work order notification to all departments of the company concerned. This notification shows the work order number assigned, date of authorization, originating department, general title and description of the purchase to be made or the work to be performed, and the classification of charges corresponding to the classification of the detailed estimate accompanying the work order requisition.

Concurrently with the issuance of the work order notification, the accounting department opens a new account upon its work order ledger in which are recorded in detail all transactions relating to the work order in question as they occur, together with their classification as between the several utilities, fixed capital accounts and political subdivisions. At the close of each month all charges made to open work orders for the month are totaled and are closed through a journal entry to the several general ledger accounts affected. At the same time the distribution of these charges as shown upon the work order ledger is also totaled and transferred to and summarized in another subsidiary ledger, by utilities and by the main groupings of fixed capital accounts appearing in the company's financial and operating report.

The accounting procedure used by the company in connection with retirements of its property, as mentioned above, closely follows the procedure briefly outlined in connection with additions and extensions to its property. When for one reason or another it has been determined that certain items of property are to be retired from service through displacement, abandonment or other manner of disposal and a corresponding deduction made from the company's property and plant account, a requisition, similar to the work order requisition previously described, is prepared by the interested department to bring the matter before the management for its approval and authorization. This requisition, which the company has termed a "property change requisition," gives a complete description of the plant or equipment to be retired from service and sets forth the reasons or necessity therefor. It names the department in which it originated and gives the number of the associated retirement expense job order under which the cost of dismantling and removal is to be recorded. In case the property removed is to be replaced with new equipment or new construction, the number of the associated work order covering the new equipment or construction is also shown on the requisition. Further, provision is made for recording thereon the estimated useful life of the plant or equipment to be retired, its age at retirement and its probable disposition — namely, whether it is to be sold, taken into stock or scrapped. It is accompanied by an accurate detailed inventory of the plant or equipment to be removed, abandoned or otherwise disposed of, priced according to its original cost in place, including overhead, and classified as to utilities and fixed capital accounts. A form indicating the distribution of the property to be retired as between the various political subdivisions in which the company operates also accompanies it. Before it is forwarded to the management for authorization the requisition must receive the approval of the department head under whose jurisdiction it originated.

Upon its authorization by the management it is forwarded to the accounting department, which assigns it a number and proceeds to prepare a notification, copies of which are to be sent to the several officials and departments of the company which may be concerned informing them that the retirement of certain property of the company named in the requisition has been authorized. This notification, termed a "property change notification," bears the number assigned to the requisition, the date the retirement was authorized, the name of the department originating the requisition, a general title of the retirement to be accomplished, as well as a full description of the plant and equipment to be retired, together with the reason or necessity therefor. It further shows the total original cost installed of the plant or equipment to be retired and gives the numbers of the associated retirement expense job order and the replacement work order, if the property retired is to be replaced. In addition to the data above mentioned, the notification bears a list of the several general ledger accounts, fixed-capital accounts and utilities affected, together with the amounts to be debited or credited to each, as the case may be. Instructions are also included upon the notification relative to the disposition to be made of all salvage, scrap or stock values of the property to be removed, abandoned, sold or scrapped.

The copy of the notification which is forwarded to the operating department originating the property change requisition has attached to it a blank "completion notice," which, when the

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Aug. 23	Low 1927	High 1927
ABITIBI PWR. & PAPER, 4% com.—no par	107¼	83	109
Adirondack Pwr. & Lt.—7% pf.	112¼	107	113½
Adirondack Pwr. & Lt.—8% pf.	115	112	116
Ala. Pwr., $7 cum. pf.—no par	111½	107	112½
Allis-Chalmers Mfg., 7% pf.	m111½	109	112½
Allis-Chalmers Mfg., 6% com.	107½	88	111½
Aluminum Co. of Amer., com.	k 90½	67½	105
Aluminum Co. of Amer., 6% of	104	101½	104½
Amer. & Foreign Pwr., pf. 25% pd.	m110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	102	86½	102
Amer. & Foreign Pwr., com.—no par	24½	18½	25½
Amer. Bosch Magneto, com.—no par	22½	13	22½
Amer. Brown Boveri Elec†	8½	8½	39½
Amer. Brown Boveri Elec., pf. $7	40	40	98
Amer. Gas & Elec., 6% pf.—no par	102½	95½	105½
Amer. Gas & Elec., com.†—no par	107½	68½	107½
Amer. Lt. & Trac., 6% pf.	115	112	120
Amer. Lt. & Trac., new com.	k169	164½	177
Amer. Pwr. & Lt., 6% pf.	104	97½	105
Amer. Pwr. & Lt., com.†—no par	62½	54	67
Amer. Pub. Serv., 7% pf.	a100	94	104
Amer. Pub. Serv., com.†	65	....	....
Amer. Pub. Utilities, 7% ptc. pf	86	73	88
Amer. Pub. Utilities, 7% pr. pf.	92	88	93
Amer. Pub. Utilities, com.	60	65	70
Amer. States Sec., A.	3½	2½	4½
Amer. States Sec., B.	3½	2½	4½
Amer. Superpwr., 6% ptc. pf.—25	k 29½	26½	29½
Amer. Superpwr., 6% 1st pf.	j 98	....	....
Amer. Superpwr., Class A†—no par	k 34½	27½	38½
Amer. Superpwr., Class B†—no par	35½	28½	39½
Amer. Wtr. Wks. & Elec., 7% pf.	m111½	104½	111½
Amer. W. W. & E., com. $1.60—20	105	62½	105
Anaconda Copper cap. $3	47½	41½	49½
Appalachian Electric Pwr., 7% pf.	102½	100	105
Appalachian Elec. Pwr., com.	78	77	83
Arizona Pwr., 7% pf.	73	77	84½
Arizona Pwr., com.	20	....	....
Arkansas Pwr., & Lt. 7% pf.	103½	....	....
Assoc. Gas & Elec., $3.50—50	51½	....	....
Assoc. Gas & Elec., pf.—$6—no par	93	85	93
Assoc. G. & E., Class A, 10—no par	41½	35	43
BABCOCK & WILCOX, 7% com.	114	113	124
Binghamton L., H. & P., $6 pf.	99	93	100
Birmingham Elec., pf.—$7—no par	108	105	109
Blackstone Valley G. & E., 6% pf.	106	103	105
Blackstone Valley Gas & Elec., 10% com.—50	139½	98	154½
Blaw-Knox, com.†	f 75	70	75
Brazilian Trac., Lt. & pwr., com.†	f175	....	....
Broad River Pwr., 7% pf.	101	97	103
Brooklyn Edison, 8% com.	181½	148½	184½
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	j 26	....	....
Buffalo, Niagara & East. Pwr. com. $1—no par	j 34½	....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	97	96	99½
California Ry. & Pwr., 7% pf.	135	125	150
Carolina Pwr. & Lt., pf.—$7—no par	f109½	107	109
Central & S.W. Util., $7 pf.—no par	a 96½	93½	97½
Central & S.W. Util., pr.in.$7 pf.—no par	a103	98½	104½
Central Ariz. Lt. & Pwr., 8% pf.	k 97	95	98
Central Ark. Ry. & Lt., 7% pf.	102	100	104
Central Ill. Pub. Serv., $6 pf.	a92½	88½	95½
Central Ind. Pwr., 7% pf.	92	84	95
Central Pwr. & Lt., 7% pf.	101	100½	103
Central States Elec., 7% pf.	96	93	97
Central States Elec., com.†	m200	....	....
Century Elec., 6% com.	m115	115	115
Chicago Fuse Mfg., com.—$2.50 no par	a 35	30	35
Cincinnati Gas & Elec., 5% com.	g100	96½	100
Cities Service, $6 pf—no par	j 90½	89½	90½
Cities Service, pf. B—no par	j 8½	7½	8½
Cities Service, pf. BB—no par	j 82	81	85½
Cities Service, com.—20	j 49½	40½	58½
Cities Service, Bks. Shrs.—10	j 24½	22½	29½
Clarion River Pwr., 8% pf.	95	....	....
Cleveland Elec. Illg., 6% pf.	109	108	112
Cleveland Elec. Illg., 10% com.	320	285	330
Columbia Gas & Elec., 6% pf.	106	99½	107½
Columbia G. & E. com. $5—no par	97	82½	98½
Columbia Ry., Gas & Elec., 6% pf.	m 98	97	100
Columbus Elec. & Pwr., $2 com.—no par	64	....	....
Columbus Ry., Pwr. & Lt., 6% 1st pf.	102½	98½	102½
Columbus Ry., Pwr. & Lt., 6½% pf. B	101½	96	103½
Columbus Ry., P. & L., com.—no par	100	75	105
Commonwealth Edison, 8% com.	a152½	138	155
Commonwealth Pwr., 6% pf.	99½	91½	99½
Commonw'th Pwr., $2, com.—no par	59½	48½	59½
Conn. Lt. & Pwr., 8% pf.	121	119	123
Conn. Lt. & Pwr., 7% pf.	117	112	118
Cons. Gas of N. Y., pf.	98½	93	99
Cons. Gas of N. Y., com $5—no par	113½	94	114½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	e109½	106½	109½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	e114½	110½	114½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	e117	112½	117
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	e130	127	130
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $2.50—no par	e 60	51	62
Consolidated Pwr. & Lt., 7% pf.	105	100	106
Consumers Pwr., 6% pf.	102	100	102
Consumers Pwr., 6.6% pf.	105½	103	105½
Continental Gas & Elec., 8% ptc. pf.	108	103	106½
Continental Gas & Elec., 7% pr. pf.	102½	100	103
Conti. G. & E. com. $4.40—no par	200	210	225
Crocker Wheeler, com.†	25	30	38
Crocker Wheeler, 7% pf.	82	78	88
DALLAS PWR. & LT., 7% pf.	109½	107	110½
Dayton Pwr. & Lt., 6% pf.	k106	101	107
Detroit Edison, 8% com.	151½	133½	157
Dubilier Condenser, com.—no par	3½	3½	5½
Duquesne Lt., 7% pf.	k115½	114½	116½
EASTERN NEW YORK UTIL., $7 pf.	107	102	104½
Eastern New York Util. com.	65	70	75
Eastern States Pwr., $7, com.	8	9	13
Eastern States Pwr., pf.	90	90	95
East. Tex. Elec., 7% pf.	107	106	108
Edison Elec. of Boston, $12 com.	d245	217	267
El Paso Elec., 7% pf.	107	105	107½
Elec. Bond & Share, 6% pf.	f109½	105½	109½
Elec. Bd. & Sh. Sec., com. $1—no par	j 74	67½	79½
Electric Household Util.†	a 12	11	15½
Elec. Investors, 6% pf.—no par	96	92	96
Elec. Investors, com.†—no par	37½	32½	40½
Elec. Investors, 10% pd. receipts	m 15	....	....
Elec. Pwr. & Lt., ctfs. pf.	105	96	106½
Elec. Pwr. & Lt., ctfs., 40% pd.	k113½	103½	115
Elec. Pwr. & Lt., ctfs, full pd.	m114	108½	111½
Elec. Pwr. & Lt., ctfs., com.—no par.	25½	16½	25½
Elec. Refrig. cap.†	15	12½	37½
Elec. Ry. Securities, com.—no par	6½	....	....
Elec. St. Battery com. $5.25—no par	71½	63½	79½
Elmira Wtr., Lt. & R.R., 7% pf.	103	99	101½
Emerson Elec., pf.	m109	107½	111
Empire Pwr., ptc.†	36	26	39
Engr. Pub. Serv., $7 pf.—no par	m104½	93½	106½
Engr. Pub. Serv., com.—no par	32½	21½	32½
Eureka Vacuum Cleaner, com. $4—no par	68½	50	77
FAIRBANKS MORSE, 7% pf.	k108	107½	112
F.-M., com.—$3—no par	39	37½	43½
Federal Lt. & Trac., com. $1.40	42½	37½	47
Federal Lt. & Trac., $6 pf.—no par	k 97½	91½	99½
Ft. Worth Pwr. & Lt., 7% pf.	f111	108	112
GALVESTON-HOUSTON ELEC. 6% pf.	73	68	72
Galveston-Houston Elec., com.	28	22	31
Gen. Elec., $3 com.—no par	129½	81	131
Gen. Elec., special—6%	11½	11	11½
Gen. Gas & Elec. (Del.) com. A. $1.50—no par	40	34	47½
Gen. G. & E. (Del.) com. B—no par	45	35½	44½
Gen. G. & E. (Del.) pf. A. $8—no par	k116	113½	120
Gen. G. & E. (Del.) pf. A $7—no par	k108	100	109½
Gen G. & E. (Del.) pf. B $7	k102	96	105
Gen. Pub. Serv., $7 cum. pf., no par	k109	105½	111½
Gen. Pub. Serv., com., no par	13½	11½	15½
Ga. Lt., Pwr. & Rys., 6% pf.	92	87	96
Ga. Lt., Pwr., & Rys., com.	50	50	80
Ga. Ry. & Pwr., 8% pf.	k123	119	125
Ga. Ry. & Pwr., 7% pf.	k113½	106	110
Gt. Western Pwr., 7% pf.	h102	....	....
IDAHO PWR., 7% pf.	107½	103	109
Ill. No. Utilities, 6% pf.	k 88	88	92
Ill. Pwr. & Lt., 7% pf.	101½	99	101½
Ingersoll Rand com. $8	91	88½	96½
Int. Combus. Engr., com. $2—no par	52½	43½	64
Int. Util., Class A—$3.50—no par	40½	28	41½
Int. Utilities, Class B—no par	5½	3	7½
Interstate Pwr., pf.—$7—no par	94	93	98
Interstate Pub. Serv., 7% pf.	99	98	99½
Iowa Ry. & Lt., 7% pf.	98	97	99
JERSEY CENTRAL PWR. & LT. CO., 7% pf.	102	97½	103
Johns-Manville, com.†—no par	i105½	55½	105½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Aug. 20. *l*Bid price Wednesday, Aug. 24. *m*Latest quotations available. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Aug. 23	Low 1927	High 1927
KANSAS CITY PWR. & LT. pf.$7	k110	112	115½
Kansas Gas & Elec., 7% pf.	l106½	103	107
Kentucky Hydro-Elec., 7% pf.	a 99	94½	99
Kentucky Sec.,6% pf.	84	83	87
Kentucky Sec., 5% com	109	110	115
Kentucky Utilities, 6% pf.	99½	95	98½
Keystone Pwr. & Lt., pf.	98	95	100
LACLEDE GAS LT., 12% com.	k 230	173½	267½
Lehigh Pwr. Sec., com.—no par	18	15	20
Long Island Ltg., 7% pf.	109½	107	112
Long Island Ltg., com.†—no par	145	139	153
Los Angeles Gas & Elec., 6% pf.	k102	98	104½
Louisville Gas & Elec., cl. A. $1.75	k 27½	23½	28
MAN. ELEC. SUPPLY, cap. $5 —no par	54	50½	132
Manila Elec., com.†—no par	k 47	40	50
Maytag Mfg., com. .50—no par	32½	23½	34½
Memphis P. & L., pf.—$7—no par	109	107	109
Metropolitan Ed., pf.—$6—no par	100	93	100
Metropolitan Ed., pf.—$7—no par	108	104	108
Metropolitan Ed., com. $5—no par	70	60	72
Middle West Utilities, 7% pf.	a112	110½	113½
Middle West Util., 8% pr. lien	a121½	117½	122½
Middle West Util., com. $6—no par ex. div.	a110½	108	117½
Midland Utilities, pr. ln. 7% pf.	a105	92½	106
Midland Utilities, 6% pf. A	a102	92½	106
Milwaukee Elec. Ry. & Lt., 7% pf.	k102	100	103
Milwaukee Elec. Ry. & Lt., 6% pf.	k 98½	98	101½
Minn. Pwr. & Lt., 7% pf.	l106½	104	107
Miss. Pwr. & Lt., $8 pf.	m101	106	103
Miss. River Pwr., 6% pf.	101	94	103
Miss. River Pwr. 3% com.	62	....	....
Mohawk Hudson Pwr., 1st pf.—$7 —no par	105	100	109
Mohawk Hudson Pwr., 2d pf.—$7 —no par	100½	94	103½
Mohawk Hudson Pwr., com.—no par	31	20½	32½
Montana Pwr., 7% pf.	m106½	118½	106½
Montana Pwr., 5% com.	103½	81½	106½
Montreal Pwr., 7% com.	f 88½	....	....
Mountain States Pwr., 7% pf.	100	97	101
Mountain States pwr., com.†	18	....	....
NASSAU & SUFFOLK LTG., 7% pf.	107	98	105
National Carbon, 8% pf.	m139½	130½	139½
National Elec. Pwr., A†	24½	23½	25½
National Lt., Ht. & Pwr., com.	24	....	....
National, Light, Ht. & Pwr., 5% pf.	70	70	74
National Pwr. & Lt., pf.—$7—no par	k106½	101	108½
National Pwr. & Lt., com.†—no par.	22½	19½	23½
National Pub. Serv., 7% pf.	97	93	100
National Pub. Serv., 7% pfe., pf.	113	108	115
National Pub. Serv., A com. $1.60—no par	21½	18½	24
National Pub. Serv., B com.—no par	18½	14	20½
Nebraska Pwr., 7% pf.	l109½	106	109
Nevada-Calif. Elec., com.	k 26	22	27
New Brunswick Pwr., 4% pf.	60	....	....
New Eng. Pub. Serv., pr. ln. pf. $7..	97	98½	101
New Eng. Pub. Serv., pf. $7.	96	95	97½
New Orleans Pub. Serv.—7% pf.	104	103	105½
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	90	91	97
N. Y. Central Elec., 7% pf.	101½	101	104
Newport News & Hampton Ry., Gas & Elec., 5% com.	109	....	....
Newport News & Hampton Ry., Gas & Elec., 7% pf.	109	....	....
Niagara Falls Pwr., 7% pf.—25.	28½	27½	29½
Niagara, Lock. & Ont. Pwr., 7% pf.	111	110½	113
No. Amer., 6% pf.—50.	53	50	55
No. Amer., com.—10	50½	45½	52½
No. Amer. Edison, $6 pf.—no par.	k102½	96½	102½
No. Caro. Pub. Serv., pf.—$7—no par	96	93	102½
Northeastern Pwr., com.	19	14½	20½
No. N. Y. Utilities, 7% pf.	106	103	109
No. Ohio Pwr., com.—no par.	13½	9½	13½
No. Ohio Trac. & Lt., 6% pf.	83	78	81
No. Ohio Pwr. & Lt., 7% pf.	94	90	93
No. Ont. Lt. & Pwr., 6% pf.	k 91	84	95
No. Ont. Lt. & Pwr., 4% com.	72	73	78
No. States Pwr., (Del.) 7% pf.	104	101	107½
No. States Pwr., (Del.) 8% com.	123	109½	124
No. Texas Elec., 6% pf.	k 66	65	70
No. Texas Elec., com.	22	27	36
OHIO BRASS, com. B $4—no par.	82	74	85
Ohio Brass, 6% pf.	105	100	105
Ohio Pwr., 6% pf.	100	96	103
Ohio Pub. Serv., $6 pf.	98	95	96½
Ohio Pub. Serv., 7% pf.	105½	103	109
Ohio River Edison, 7% pf.	108½	103	109½
Oklahoma Gas & Elec., 7% pf.	101	....	....
PACIFIC GAS & ELEC., 6% pf.	26½	24½	26½
Pacific Gas & Elec., 8% new com.	40½	31	39½
Pacific Pwr. & Lt., 7% pf.	l104	102	104
Penn Cent. Lt. & Pwr., $5 pf.—no par	c 76	75½	77
Penn-Ohio Edison, 7% pf.	102½	97½	104
Penn-Ohio Elec., 7% pf.	m101½	98	100
Penn-Ohio Pwr. & Lt., 7% pf.	107	99	103
Penn Pwr. & Lt.—$7—no par.	l109½	107	109
Penn Wtr. & Pwr., 8% com., new.	c 58	47½	58½
Phila. Co., 6% pf.—50.	c 52	49½	52½
Phila. Co., com.—50.	k 102	85½	110
Phila. Elec., 8% com.—25.	c 52	46½	54
Portland Elec. Pwr., 7% pf.	99	97½	101
Portland Elec. Pwr., 6% pf.	79	78	83
Portland Elec. Pwr., 6% 2d pf.	58	55	70
Portland Elec. Pwr., com.	28	22	30
Potomac Elec. Pwr., 6% pf.	m108½	....	....
Pwr. Corp. of N. Y., com. $1—no par	m 79	....	....
Pwr. Sec., pf.—no par.	k 28	28	33
Pwr. Sec., com.—no par.	k 6	5	8
Public Serv. of Colorado, 7% pf.	l102	....	....
Pub. Serv. of N. J., 6% pf.	k100	98½	101½
Pub. Serv. of N. J., 8% pf.	k131	125	132
P. S. of N. J., $2 com.—no par.	42½	32	45½
Pub. Serv. of No. Ill., 6% pf.	a105½	101½	106
Pub. Serv. of No. Ill., 7% pf.	a117	112½	117
P. S. of No. Ill., com. $8—no par.	a141	130½	143
Pub. Serv. of No. Ill., $8 com.	a139½	132	142
Pub. Serv. of Okla., 7% pr. ln.	100	99	100½
Pub. Serv. Elec. & Gas, 6% pf.	107½	102	108½
Puget Sound Pwr. & Lt., 7% pr. pf.	108	105	107
Puget Sound Pwr. & Lt., $6 pf.—no par.	79	83½	89
Puget Sound Pwr. & Lt., com.	k32	29½	36
RADIO CORP. OF AMER., $3.50 pf.—50.	53½	49	53½
Radio Corp. of Amer., com.—no par.	66½	41½	68½
Republic Ry. & Lt., pf.	m120	....	....
Republic Ry. & Lt., com.	m135	112	135
Rochester Gas & Elec. 6% pf. D.	k104½	101	103½
Rochester Gas & Elec., 7% pf. B.	103½	105	107
Rochester Gas & Elec., 6% pf. C.	103	101½	103½
SAFETY CABLE, com. $4.	68½	52½	74½
San Joaquin Lt. & Pwr., 7% pr. pf.	106	105	108
St. Joseph Ry., L., H. & P., 5% pf.	72	70	73
Servel Corp.	1½	1	10½
Sierra Pacific Elec., 2% com.	k 26½	24½	28½
Sioux City Gas & Elec., 7% pf.	101½	99	104
Southeastern Pwr. & Lt., pf.—$7 no par	l108	....	....
Southeastern Pwr. & Lt., pfe. pf.	l 81½	....	....
Southeastern Pwr. & Lt., com.—no par	37½	29½	38½
So. Calif. Edison, 8% pf.	k 39	36½	40
So. Calif. Edison, 7% pf.	28½	27½	28½
So. Calif. Edison, 6% pf.	25½	24½	27
So. Calif. Edison, 8% com.	37½	31½	36½
Southern Cities Utilities, 7% pf.	71½	70	91
Southern Cities Utilities, com. $4.	k 31½	23½	42½
Southwestern Lt. & Pwr., A $3.	63	60	65
Southwestern Lt. & Pwr., B.	63	60	65
Southwestern Lt. & Pwr., $6 pf.	89	83	91½
Southwestern Pwr. & Lt., 7% pf.	k109	103	110½
Springfield (Mo.) Ry. & Lt., 7% pf	101	95	102
Standard Gas & Elec., 8% pf.	64½	57½	64½
Standard Gas & Elec., 7% pr. pf.	107	103	110
Standard G. & E., com. $3.50—no par	63½	54	65½
Standard Pwr. & Lt., 7% pf.	99	98	102½
Staten Island Edison, pf.—$6—no par	100	99	101
Superheater, $6 com.—no par.	170	166	181½
Syracuse Lighting, 7% pf.	105	103	107
Syracuse Lighting, 8% pf.	115½	113	119
Syracuse Lighting, 8% com.—no par	m300	....	....
TAMPA ELEC., com. $2.	60½	49	64
Tenn. Elec. Pwr., 6% pf.	97½	92	97½
Tenn. Elec. Pwr., 7% pf.	107	103	107½
Terre Haute, Ind. & East. Trac., 5% pf.	26	20	30
Terre Haute, Ind. & East. Trac., com	1	1	3½
Tex. Pwr. & Lt., 7% pf.	l110	106	110
Tide Water Pwr., 8% pf.	109	105	110
Timken Roller Bear., com.—$4 no par.	129	78	142½
Toledo Edison, 8% pf.	115	115	118
Toledo Edison, 7% pf.	l106½	....	....
Toledo Edison, 6% pf.	l 98	95	97
Toledo Edison, 6% com.	98	....	....
Tri-City Ry. & Lt., 6% pf.	97	90	97
UNITED GAS & ELEC., 6% pf.	101	98	102
United Gas & Elec., com.—no par.	m 57	....	....
United Gas & Elec. (N. J.) 5% pf.	72	70	73
United Gas Impr., 8% com.—50.	c 111½	89½	113½
United Lt. & Pwr., pf.—$4—no par.	52	49	53½
United Lt. & Pwr., pf.—$6.50—no par.	96½	87	97½
United L. & P., com. A .48—no par.	13½	12½	15½
United L. & P., com. B .48—no par.	a 19	15	24
Utah Pwr. & Lt., 7% pf.	l 107½	104	108½
Utica Gas & Elec., 7% pf.	104	105	106½
Utica Gas & Elec., 8% com.	200	....	....
Utilities Pwr. & Lt., 7% pf.	95½	93	100
Utilities Pwr. & Lt., com. A $2.	31	27	34
Utilities Pwr. & Lt., com. B $1—no par.	18	13½	19
VERMONT HYDRO-ELEC., 7% pf.	98	95	100
Virginia Elec. & Pwr., 7% pf.	107	105	107
Virginian Pwr., 7% pf.	108	....	....
Virginian Pwr., com.	75	....	....
WAGNER ELEC., 7% pf.	b 87½	68	90
Wagner Elec., com.—no par.	b 32½	18½	39½
Washington Ry. & Elec., 5% com.	253	....	....
Washington Ry. & Elec., 5% pf.	92½	....	....
Washington Wtr. Pwr., 8% com.	161	136	168
West Penn Elec., 7% pf.	110½	102	112
West Penn Elec., Cl. A $7.	k108	97½	110
West Penn Pwr., 7% pf.	114½	111	118
West Penn Pwr., 6% pf.	107	100½	108½
West Virginia Lt., Ht. & Pwr., 7% pf.	92	94	96
West Va. Utilities, 7% pf.—50.	m 90	48	51½
Western Pwr., 7% pf.	102	97½	102
Western States Gas & Elec., 7% pf.	99½	96	103
Western States Gas & Elec., com.	37	....	....
Westinghouse Elec. & Mfg., 8% com. —50.	84	67½	89
Weston Elec. Instrument, Cl. A $2 —no par.	k 30½	30	34½
Weston Elec. Instrument, com.—no par.	13	13	18½
Wheeling Elec., 6% pf.	101	95	104
Worthington Pump, 7% pf. A.	k 52	46	61½
Worthington Pump, 6% B.	k 45	40	54½
Worthington Pump, com.	33½	20½	46
YALE & TOWNE com. $5—25.	83½	70½	83½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Aug. 20. *l*Bid price Wednesday, Aug. 24. *m*Latest quotations available. †Dividend rate variable.

changes in plant and equipment, as proposed in the requisition, have been accomplished, is returned to the accounting department, thus apprising that department of the fact. If it so happens that the changes actually effected in the plant are later found not to be in strict accord with the inventory submitted with the original requisition, either a revised or a supplemental requisition is prepared by the department requesting the property change, authorized by the management and forwarded with the completion notice to the accounting department.

DIFFERS FROM EXTENSION PROCESS

At this point the close parallel between the procedure governing retirements and that accorded additions and extensions ceases. No subsidiary ledgers corresponding to the work order ledger and the ledger for classification of capital expenditures are kept. Each property change requisition, or, better perhaps, each property change requisition as finally revised or supplemented upon actual completion of the change in plant or equipment contemplated, affords in itself a complete accounting record of the transaction, in that it supplies, as above noted, a complete description of the property retired, accompanied by a detailed inventory of that property, priced according to its original cost in place and classified as to utilities, fixed capital accounts and political subdivisions. There is in consequence no need for subsidiary ledgers under the company's procedure with respect to retired property, so far as it relates to the property and plant account. A salvage ledger is, however, made use of in accumulating and recording the salvage recoveries made from retired property.

This, in general, covers the accounting procedure of the Milwaukee Electric Railway & Light Company with respect to retired property, as it has been in force for a number of years past. While apparently quite simple in application, this procedure, however, has not been without its difficulties in actual practice. Items of plant and equipment are seldom perhaps retired from service in quite the same sequence or in quite the same manner in which they were originally constructed or acquired and placed upon the books of the company. Large portions of the property, for instance, no doubt were acquired through contract, and the contract figures are placed upon the books as representative of the cost of such property without further analysis or record of the individual costs of the many items of plant or equipment making up the totals. Inevitably, therefore, when portions of plant and equipment thus acquired were later on displaced or abandoned or otherwise

disposed of, and corresponding deductions were to be made from the property and plant account, difficulties arose, since it was, and is, practically impossible under such circumstances to locate or to determine accurately their original costs as placed upon the books.

New York Power & Light Corporation Stock Transfer

The New York Power & Light Corporation, plans for the formation of which were reported in the Aug. 20 issue of the ELECTRICAL WORLD, has asked the New York Public Service Commission for authority to issue the following stock: (a) $2,554,700 par value of 8 per cent preferred; (b) $14,655,000 par value of 7 per cent preferred; (c) 26,070½ shares without par value of its six-dollar preferred; (d) not to exceed seven and one-half additional shares without par value of its six-dollar preferred.

The exchange schedule for the stock transfer into the stock of the recently formed corporation, if approved by the commission, will be as follows:

Each holder of 8 per cent preferred stock of the Adirondack Power & Light Corporation will receive one share of 8 per cent preferred stock of the new consolidated corporation.

Each holder of one share of 7 per cent preferred stock of the Adirondack Power & Light Corporation will receive one share of the 7 per cent preferred stock of the new corporation.

Each holder of one share of six-dollar preferred stock of the Adirondack Power & Light Corporation will receive one share of the six-dollar preferred stock of the new consolidated corporation. Each subscriber to one share of the six-dollar preferred stock of the Adirondack Power & Light Corporation will receive one share of the six-dollar preferred stock of the new consolidated corporation on payment in full of the subscription price for such six-dollar preferred stock of the Adirondack Power & Light Corporation.

Each holder of one share of common stock of the Adirondack Power & Light Corporation, other than the Municipal Gas Company of the city of Albany, will receive one-half share of the six-dollar preferred stock of the new consolidated corporation.

Each holder of one share of capital stock of the Troy Gas Company, other than the Municipal Gas Company of the city of Albany, will receive one share of the six-dollar preferred stock of the new consolidated corporation.

Each holder of one share of preferred stock of the Adirondack Electric Power Corporation, other than the Adirondack Power & Light Corporation, will receive one share of 7 per cent preferred stock of the new consolidated corporation.

Each holder of one share of the common stock of the Adirondack Electric Power Corporation, other than the Adirondack Power & Light Corporation, will receive one-half share of the six-dollar preferred stock of the new consolidated corporation.

Each holder of one share of the capital stock of the Municipal Gas Company of Albany will receive one share of the common stock of the new consolidated corporation.

The Municipal Gas Company of Albany will surrender for cancellation the certificates for shares of stock of the Adirondack Power & Light Corporation, Troy Gas Company, Fulton County Gas & Electric Company and Cohoes Power & Light Corporation of whatever class it holds, and no stock of the new consolidated corporation will be issued in exchange therefor.

The Adirondack Power & Light Corporation will surrender for cancellation the certificates for all of the stock of the Adirondack Electric Power Corporation of whatever class it holds, and no stock of the new corporation will be issued in exchange therefor.

Fractional shares of the six-dollar preferred stock of the new consolidated corporation will not be issued, but a holder of common stock of the Adirondack Power & Light Corporation or of the Adirondack Electric Power Corporation who is entitled to a fractional share of six-dollar preferred stock of the new consolidated corporation, after consolidating all other fractions to which he may be entitled, will be permitted, on surrender of said right and the payment of cash, to subscribe for an integral share of said six-dollar preferred stock at the rate of $100 per share. The proceeds realized on the sale of 6 per cent preferred stock for this purpose will be used for payment of an equivalent amount of debt of the new consolidated corporation incurred for capital purposes or for other proper capital purpose.

The certificate of incorporation of New York Power & Light Corporation authorizes the issuance of 1,750,000 shares classified as follows: 30,000 shares $100 par value 8 per cent, preferred; 150,000 shares $100 par value 7 per cent, preferred; 320,000 shares six-dollar without par value, preferred; 1,250,000 shares without par value, common.

Company Reports

Name of Company	Gross Earnings Twelve Months Ended July 31 1927	1926
Bangor Hydro-Electric	$1,828,890	$1,650,859
Carolina Power & Light*	8,683,247	7,520,049
Central Illinois Light	4,347,086	4,080,706
Central Maine Power	5,374,370	4,957,020
Cities Service	30,078,734	21,883,727
Commonwealth Power	51,818,618	47,198,180
Consumers Power	25,764,691	22,703,439
Detroit Edison†	27,287,204	25,553,877
Idaho Power*	2,909,421	2,855,213
Illinois Power	2,617,711	2,578,542
Kansas City Power & Light	11,663,181	10,600,383
National Power & Light*	35,397,505	31,640,117
North American Company*	119,638,392	107,320,302
Northern Ohio Power	12,359,813	11,804,050
Penn-Ohio Edison	13,304,688	11,988,499
Portland Electric Power	12,057,289	11,373,051
So. Indiana Gas & Electric	3,003,530	2,808,579
Tennessee Electric Power	12,288,863	11,822,218
Utah Power & Light*	10,632,683	10,206,212

* Twelve months ended June 30.
† Seven months ended July 31.

Central Illinois Light Calls Bonds.—The Commonwealth Power Corporation has announced that its subsidiary, the Central Illinois Light Company, has called for redemption Oct. 1 at 105 and interest its first and refunding mortgage 6 per cent bonds, amounting to $1,967,500. These bonds would not have matured until 1943.

Electric Power & Light Corporation Suffered Little from Flood

RECENT appreciation in the price of Electric Power & Light common stock calls attention to the substantial progress which this group is making, as reflected in the annual statement just issued. At the time of writing the stock is quoted at 25⅝ against a low for the year of 16½.

Taking the group as a whole, gross earnings have increased by 12 per cent to approximately $50,000,000, and net are up 17 per cent. This increases the gross of the corporation itself by 72 per cent to $7,510,530. Of the revenue of the entire system, 61 per cent is derived from power and light business. The assets of the company are now $104,008,429, against $96,530,611 the previous year.

Shareholders of Electric Power & Light have naturally been interested in the effect on the company of the disastrous floods on the Mississippi and its tributaries. Part of the territory served by subsidiaries in Arkansas, Mississippi and Louisiana was affected. It is gratifying to note at this date, when there has been ample time for thorough investigation, that subsidiary companies suffered only relatively small damage and, "through the efficacy of transmission-line service and interconnection with other properties, . . . there were no material interruptions of service affecting any large number of consumers. The value of interconnection and transmission-line service was forcibly demonstrated in this abnormal situation, as without it many communities would have been without electric service. . . . The largest community served by your subsidiaries actually subjected to flood was Greenville, Miss., having a population of 16,000, and electric service was maintained there without serious interruption."

Manila Electric Corporation Issues Annual Report.—The annual report of the Manila Electric Corporation for the year ended Dec. 31, 1926, shows gross income of $879,740. Operating expenses and taxes amounted to $93,831, leaving net income of $785,909. Dividends totaled $729,918, leaving a balance for surplus of $55,990, which added to the surplus balance as of Jan. 1, 1926, gives the company a total surplus as of Dec. 31, 1926, of $178,518 before additional provision for federal income taxes. This item amounts to $165,608, leaving a surplus balance at the end of the year of $12,910. The corporation's balance sheet as of Dec. 31, 1926, showed securities owned and receivable under contracts of $14,352,910 and dividends receivable of $166,667, making total assets of $14,519,577.

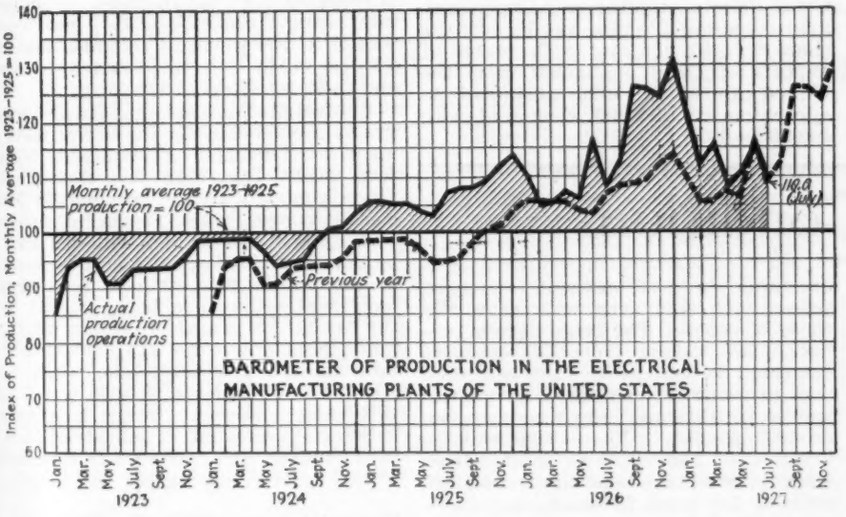
Manufacturing and Markets

Activity 5.3 Per Cent Over Last Year

Production in Electrical Manufacturing Plants Holding Up Well—Seven Months' Production 4.4 Per Cent Over Same Period of Last Year

THAT the electrical manufacturing plants of the nation opened the second half of the year with a rate of production considerably over that recorded during July of last year is indicated by reports received by the ELECTRICAL WORLD on the monthly consumption of electrical energy in a large proportion of these plants. In June the productive activity was slightly under that for the same month of last year. The present summer's activity has followed very closely the trend recorded during the same period last year, this year being on a slightly higher plane for the most part. Both years witnessed an increased rate of activity during June over the previous May, and both years also recorded decreased activity during July. The actual production during the first seven months of this year, however, has been 4.4 per cent over the same period of last year. Only during June was the productive activity under that of the same month of last year.

Data Unadjusted for Seasonal Variation



The actual production of the electrical manufacturing plants during July was 4.6 per cent under June, but was 1.3 per cent over July of last year. However, after corrections are made for the number of working days in the several months, it is found that the rate of production during July was about 0.7 per cent under that of June, but was 5.3 per cent over that of July of last year, both of the comparative months having one more working day than July of this year The smaller manufacturers taken as a group reported a July activity 1.6 per cent under that of June, while the large manufacturers taken as a group reported a 1.7 per cent increase in activities.

The July productive activities of the electrical manufacturing plants as compared with July of last year were about on the same plane as was reported by American industry as a whole. July reports of electrical energy consumption from approximately three thousand manufacturing plants scattered throughout the nation and consuming more than fifteen billion kilowatt-hours per annum indicate that the productive activities of general industry during that month were 4.7 per cent over July of last year and 12.7 per cent over July of 1925. July general production this year was only 8.7 per cent under that of February, the month of peak activity during each of the past three years, which is a comparatively low rate of seasonal decrease when it is remembered that in 1926 this curtailment of productive activity during the same period was 14.9 per cent and that in 1925 it was 12.9 per cent. Indications are that general production during the present summer is holding up better than during any similar period since the war.

Soviet Republic Issues Business Publication

Information on the economic and financial situation of the Union of Socialist Soviet Republics, and especially on Soviet foreign trade, is contained in a special publication under the title of "Exports, Imports and Concessions of the Soviet Union," issued by the Board of the State Trading Import and Export Office ("Gostorg") of the Russian Socialist Federated Soviet Republic. The book contains information concerning export from the United States of America to the Soviet Republic, laws concerning foreign trade and customs tariffs, Russian currency, banks and systems of finances of the Soviet Republic; provisions and regulations regarding the obtaining of concessions in the Soviet Republic, and general information.

Commerce Yearbook for United States Available

The remarkable industrial progress of the United States for the year 1926, which was one of marked prosperity in American trade and industry, is told in the Commerce Yearbook (Volume I), issued by the United States Department of Commerce. This year for the first time a survey of the principal foreign countries has been made and will be issued as Volume II of the Commerce Yearbook. This second volume will contain the latest available data on foreign markets obtained from official and other reliable sources, with maps and charts, and will be ready for distribution about Oct. 1.

Regarding electrification of the manufacturing industry the yearbook states:

"The increase in the electrification of the manufacturing industry in the United States is indicated by the figures in the accompanying table. According to the Census of Manufactures, the horsepower of prime movers owned by factories in 1925 was 35,773,000 as compared with 18,406,000 in 1914. Moreover, the increase in the horsepower of electric motors operated by purchased current was 308 per cent and of those operated by prime movers owned by factories 108 per cent. Assuming that the latter were operated at 72 per cent of capacity, the capacity

CAPACITY OF PRIME MOVERS AND ELECTRIC MOTORS IN MANUFACTURING PLANTS

	Horsepower (In Thousands)		
	1914	1923	1925
Prime movers owned by factories	18,406	19,728	35,773
Electric motors operated by purchased current	3,885	13,366	15,869
Total power equipment	22,291	33,094	51,642
Electric motors operated by prime movers owned by factories	4,939	8,821	10,255
Estimated capacity of factory prime movers used to actuate motors	3,550	6,350	7,380
Total power electrified	7,435	19,716	23,249
Per cent of electrification	33	60	45

of factory prime movers used to actuate them represented 7,380,000 hp. in 1925. This figure added to that for motors operated by purchased current gives a total of 23,249,000 hp. of electrified power, or 45 per cent of the total power equipment in 1925. This is 36 per cent greater than it was in 1914.

"The latest available data on the use of electric power in mines and quarries are for the year 1919. At that time the horsepower of motors which operated on purchased current was 1,603,300, while motors aggregating 1,259,000 hp. were operated by current generated by the establishments themselves. Although it is scarcely probable that the increase in electrification in mines and quarries has kept pace with that in manufacturing establishments, there has undoubtedly been much progress in the same direction.

Great Britain a Big Exporter of Electrical Goods

Semi-official figures from the Canadian press indicate that Great Britain is now leading other countries as an exporter of electrical goods. The exports for the year ended June 30 last, on a horsepower basis, showed an increase of 28 per cent over those of 1920. During the first five months of this year British export shipments of electrical goods totaled in value £7,750,000, an increase of over 11 per cent compared with the exports for the corresponding period of 1926, which constituted a record at the time. During this period German exports declined 3 per cent, American exports remained stationary, French exports fell off 24 per cent and Switzerland's exports advanced 10 per cent.

South Africa imported an increasing amount of electrical equipment during 1926, according to official trade statistics, says the electrical equipment division of the Department of Commerce. The value of total imports in this line increased from £2,230,500 in 1925 to £2,384,500 in 1926.

Although Great Britain supplies the bulk of this class of equipment, the value of imports from that country for 1926, as compared with 1925, decreased £47,200, and during the same period imports from the United States gained £12,250. Germany also made a gain during 1926, the value of German material taken by South Africa amounting to £51,000 more than in 1925.

Imports of electrical heating and cooking appliances increased appreciably, heating amounting to £69,000 for 1926, as compared with £36,000 in 1925. Great Britain supplied over 50 per cent, approximately £35,000, but in 1925 its share was 67 per cent. The value of imports of these appliances from the United states in 1926 amounted to approximately £12,000, compared with £4,000 in 1925.

Business Conditions

BUSINESS in the electrical industry cannot be said to be particularly active, nor can it be classed as dull. There is a seasonal quietness, although inquiries are in fair volume. Central-station companies generally are purchasing material in good volume, but the industrial market has declined.

In New England power apparatus is active and there is a decided improvement in the demand for motors. Central-station material is selling well and includes an order for 1,000 poles with cross-arms for trunk-line construction. A decrease in sales is noted in the New York district, but a fair number of inquiries are reported. Many transformer sales made in the Southeast totaled over $280,000. The demand for poles is also active. A very satisfactory amount of industrial business is pending. Business in St. Louis is maintaining a volume a little above that of August last year. In the Middle West sales continue to improve slightly and the volume compares very favorably with that of last year. On the Pacific Coast small-motor business is in good volume, and Hawaiian Island orders have been particularly good.

Metal Prices Decline Slightly in Continued Quiet Market

With the exception of tin, the prices of all of the more important non-ferrous metals are somewhat lower in both the American and English markets than they were a week ago. Considering the quietness in the demand, however, prices have held very well, especially those of copper. The large copper producers are asking from 13¼ cents to 13⅜ cents delivered with full realization that these quotations are only nominal and to be obtained only where special conditions apply. Those who make a practice of selling their intake from week to week are quoting from 13.05 cents to 13¼ cents for customary Eastern deliveries but are selling only a very moderate tonnage, there being little interest by consumers at any price. Meanwhile, copper is being consumed at a lively rate, even if consumers are not so active as earlier in the year, and a good buying movement is expected to assert itself early in September. Some requests have been made to anticipate deliveries, consumers apparently preferring to do this where possible rather than to book further orders. Dealers are apparently holding more copper than usual, and several hundred tons have been picked up during the week as low as 13 cents, delivered. This seems to be largely of one brand. The foreign demand has been as quiet as the domestic, though a little more interest was taken abroad on Wednesday, coincident with a reduction in the c.i.f. price of the export association from 13.65 cents to 13¼ cents.

NEW YORK METAL MARKET PRICES

	Aug. 17, 1927 Cents per Pound	Aug. 24, 1927 Cents per Pound
Copper electrolytic	13.10	13.05–13.075
Lead, Am. S. & R. price	6.65–6.75	6.60
Antimony	11⅛	11⅛–11¼
Nickel, ingot	35	35
Zinc spots	6.70	6¼
Tin, Straits	63.75	64⅜
Aluminum, 99 per cent	26	26

Base copper price Aug. 24, 1927, 15¼ cents.

Many Transformer Sales Reported in Southeast

Transformers continue to be the most active line in the electrical field in the Southeast. An Alabama utility ordered large power transformers amounting to $180,000, a Florida central-station company placed orders for approximately $100,000 worth of this equipment, and a Georgia company ordered $6,400 worth of distribution and small power transformers. Pole sales are also very active, one company's orders for creosoted pine poles during the past two weeks having aggregated $15,000, while another company purchased creosoted pine poles costing $5,200. There is a sustained activity in meter sales. An order placed covered $7,750 worth of the 5-, 10- and 25-amp. meters, and the demand from the territory as a whole is reported very satisfactory. Another interesting central-station purchase was of $4,990 worth of stranded underground cable and miscellaneous wire and cable totalling $5,000.

Central-station merchandising programs are reflected in the active movement of household appliances. In a four weeks' campaign just closed one power company sold approximately 500 electric ranges, while another company sold 8,000 flatirons in a month's campaign. Sustained activity is to be noted in the textile field, though few large individual orders are being placed by the mills. A South Carolina textile mill placed orders for $15,000 worth of mill construction materials, while an Alabama mill ordered $11,000 worth of this same material. There is a very satisfactory amount of industrial business pending, and activities in this field should be brisk during the fall months.

Power Apparatus Active in New England District

Decided improvement in the demand for motors is a feature of the New England trade. Industrial plants and machinery makers are both active in the market. A canvass of leading houses reveals an upward trend in such sales compared with the preceding week, and a number of important orders are reported of the magnitude of $10,000 to $15,000 each, with one sale of $20,000 to a traction company for passenger-station motor equipment. Many small scattered motor orders are also being placed by New England industries. Central-station material is selling well, a Maine company having just bought 1,000 Western red-cedar poles and cross-arms for trunk-line construction, the hardware order not having been placed as yet. Important wire bids are under consideration, together with motors for municipal pumping service. Two textile machinery houses purchased motors for special application.

The Boston Edison company and the

Central Maine Power Company have each purchased a 5-ton, four-wheel-drive line truck with power-operated hole-drilling equipment. Eight 3-ton industrial electric trucks were purchased for use in an electrically equipped bakery in Somerville, Mass. A Boston engineering house is handling an industrial steam turbine job of 20,000-kw. combined rating for installation outside New England, and engineering studies are being made for further central-station steam-plant development in eastern Massachusetts. Jobbers report a modest improvement in trade, but socket appliance sales are a trifle dull with the exception of the perennial flatiron. Electric elevators and improved lighting installations are going into office-building service at Boston, and arrangements are being perfected for a store-lighting campaign in that district.

Decrease in Sales Noted in New York District

Central-station buying of electrical apparatus in the New York district is generally dull, but inquiries are in fair volume. Several manufacturers report sales for the past month to be less than for the corresponding period last year. This situation is not confined to any one type of equipment but is pretty generally reported in all lines of the industry. In the industrial field sales are also decreasing. The demand for control apparatus is poor and there is also a recession in the sale of motors of all sizes.

Business in St. Louis Maintaining Good Volume

Reports from all branches of the electrical industry indicate that general business in the St. Louis district is holding a little above that of August last year. A contract for transformers, outdoor switches and steel substation structure was placed by one of the power companies in northern Arkansas at a total cost of $140,000. Another order for transformers and switching equipment amounting to $15,000 was booked for a distributing company south of St. Louis, and a set of high-tension switches with operating mechanism, costing $30,000, was bought by a central-station company in the southwestern part of the district. Manufacturers of medium-sized motors and transformers state that the demand is steady and in good volume. Jobbers report orders coming in somewhat better than they were in the previous week.

Improvement of Business Continues in Middle West

Business in the Middle West continues to improve slightly. The volume, while not exceptionally large, is getting larger and compares favorably with that of last year. Reports from agricultural districts indicate improvement, and general industrial activity is slowly increasing. The various utility companies are placing commitments farther in advance, and considerable construction work is under way. Quite a large amount of apparatus purchasing is being done, and there is a good demand for maintenance materials. Among the interesting items ordered were a 400-kva. motor-generator set, three 1,200-amp., 15,000-volt oil circuit breakers, twelve 3,000-amp. and twelve 4,000-amp., 15-kv. disconnecting switches, six 5-in. eight-stage pumps, a large order for spare boiler parts and a large quantity of weatherproof wires and cables. Jobbers' sales are about the same as they were last week. Appliances continue to move in fair volume with the exception of fans. Waffle irons are selling best, and it is expected that a large amount will be sold this fall since campaigns will be put into force at that time.

Small Motor Business in Good Volume on Pacific Coast

Small-motor business on the Pacific Coast is in good volume. Orders reported include 500 ½-hp. units, amounting to $17,500, for a Los Angeles manufacturer of automotive equipment; 120 assorted units from ¼ hp. to ¾ hp., amounting to $2,500, for oil-burner equipment; also 200 ¼-hp. motors, valued at $2,500, for a manufacturer of washing machines. Other interesting power orders have included a main distribution board, costing $25,000, for the new motion-picture theater to be built in San Francisco. Hawaiian Island orders have been particularly good and have included two switchboards, costing $9,500, for two different sugar plantations, three 500-kva. transformers, totaling $7,000, for a Honolulu dredging company, and an inquiry covering about $3,500 worth of wiring material. Observers at the fourth annual Radio Exposition in San Francisco predict a good radio business in the fall. Power company and railroad buying is again light.

Motor and heavier apparatus sales in Seattle and the Puget Sound district consist only of small and scattered orders. The port of Kelso issued specifications for motors for a grain elevator costing approximately $500,000, and the port of Tacoma is planning a cold-storage plant. The British Columbia Railway Company, Vancouver, B. C., has issued a call for bids for boring 13,200 ft. of tunnel, 13 ft. in diameter, as a part of its thirteen-million dollar hydro-electric project. The City of Klamath Falls, Ore., is planning an expenditure of $50,000 for a street-lighting system.

Activities of the Trade

Electric Street Truck Sales Show Gain

Electric street truck sales increased 10 per cent during the first half of the current year as compared with the same period in 1926, according to *Electric Transportation News*. Sales records continue to indicate the trend toward the purchase of transportation equipment in fleet lots rather than by single units. It is also of interest to note that the dairy industry purchased 68 per cent of the total number of electric trucks sold during the first six months of this year. One of the largest fleet purchases was made by the Borden's Farm Products Company, Inc. This order included 31 electric trucks for use on retail routes in East Chicago, Ind., and fifteen electrics, 3½-ton machines, which displaced 55 horse-drawn trucks on Borden's wholesale routes in New York City.

Westinghouse Gets Railway Electrification Contract

The Westinghouse Electric & Manufacturing Company, through F. H. Shepard, director of heavy traction, announces the closing of a contract with the Great Northern Railway for additional locomotives to be used on the extension of electric service in the Cascade Mountain section of the railway's transcontinental line. This extension is a part of the $15,000,000 program of improvement, which includes line revision and an 8-mile tunnel through the Cascade Mountains.

These locomotives, of the motor-generator type, duplicate the locomotives placed in successful operation this spring. They were built jointly by the Baldwin Locomotive Works and the Westinghouse company. The present contract covers six units at an approximate price of $1,000,000.

Maytag Assets Three and One-Half Times Liabilities

For the period ended June 30, 1927, Maytag reported net earnings of $3,226,257, compared with $3,073,683 in a similar period last year. The organization topped last year's record showing, when the business exceeded by 48½ per cent that of 1925. Total assets, which as of March 31, 1927, were $11,945,909 compared with $8,119,319 at the end of 1925, rose still further to $12,825,054, as of June 30, 1927. Net working capital, which had jumped at the end of 1926 to $6,001,396 from $3,624,976 in the preceding year, increased to $6,447,681 at the end of the half year in 1927. Current assets were $8,863,540 against current liabilities of $2,415,859.

Electric Refrigeration Halves Overhead

Considerable progress has been made by the new management of Electric Refrigeration Company in restoring it to a profitable earnings basis. Heavy inroads have been made on overhead expenses, which have been reduced from $600,000 a month to around $300,000. This in itself represents a saving of $3,600,000 annually. Economies effected through the consolidation of manufacturing operations of Kelvinator and Nizer and the elimination of factory branches which have proved costly will result in annual savings of at least $3,000,000 on a gross business of $21,000,000, about the current year's

volume. It is expected such a saving will be realized in the coming year's business.

Kelvinator sales in the domestic field so far this year have exceeded the corresponding period of last year by 94 per cent, while sales of commercial equipment, which were lagging considerably, have recently picked up. Inventories are being reduced materially, following the introduction of a policy of keeping production schedules close to the market. So far the market for commercial units, which are manufactured by the Nizer division, has only been scratched, in the opinion of the management, and it is expected that the volume of this branch of the business will increase considerably in the next fiscal year.

International Combustion Acquires Sulzer System

George E. Learnard, president of the International Combustion Engineering Corporation, 200 Madison Avenue, New York, announces the acquisition from Sulzer Brothers, Winterthur, Switzerland, of the Sulzer system for dry quenching coke. The system will be developed in this country by a new subsidiary, the Dry Quenching Equipment Corporation. The Sulzer system is used in Europe for cooling coke without the use of water. Steam is produced for power and plant purposes during the cooling process, thus diverting to useful work the sensible heat of the coke, at present lost by wet quenching.

The first unit in America was installed by Sulzer Brothers for the Rochester Gas & Electric Corporation, where the equipment is said to be exceeding the manufacturer's guarantee in daily operation. The directors of the new corporation are: George E. Learnard, chairman; H. D. Savage, president; G. G. G. Hunter, vice-president; George H. Hansel, treasurer; Hans Sulzer and F. Oederlin of Winterthur, Switzerland, and E. N. Goodwin, New York. Walter Sennhauser, at present connected with Sulzer Brothers of Winterthur, will come to this country as chief engineer.

The A. J. Lindemann & Hoverson Company, Milwaukee, manufacturer of electric cooking and heating appliances, announces the production of a new line of "L. & H." water heaters. It is made with automatic temperature control or non-automatic for 110 or 220 volts for a power consumption from 2,000 to 5,000 watts. An immersion type heater for 110 or 220 volts with a consumption of 750 and 1,000 watts is also available.

The Rome Wire Company, Rome, N. Y., manufacturer of electrical wires and cables, announces the addition of steel taped underground cable to its line. The company recently erected a completely equipped building at its plant in Rome for the manufacture of steel taped underground cable, and several interesting new lines will be added later. The company is now ready to give quotations and accept orders for underground cable.

The Silvray Company, Inc., 55 West Sixteenth Street, New York, manufacturer of the Silvray system of indirect illumination, announces the appointment of the Silverlite Company, 150 Post Street, San Francis'o, as its distributor for the Pacific Coast. The company also announces that the Silvray products are being handled in the Pittsburgh district by the Silvray Company of Pittsburgh, 211 Renshaw Building. Among the new products brought out by the company is the "Spraylite" lamp. This is a standard lamp having a permanent silver reflector which controls the direction of the light rays coming from the filament.

The Electro-Nite Carbon Company, 306 North Fourth Street, Philadelphia, manufacturer of carbon brushes, announces the promotion of D. T. Jacobs from sales manager to general manager, and of J. S. Marcus from the sales department to sales manager.

The General Electric Company has received an order for electric motors, for the two-thousand-barrel cement plant of the Northwestern Portland Cement Company at Grotto, Wash., ranging from 650 hp. down. The contract was placed through the Puget Sound office of the Traylor Engineering & Manufacturing Company and amounts to about $20,000.

The Emerson Electric Manufacturing Company, St. Louis, has purchased a modern five-story concrete building in St. Louis, containing 85,000 sq.ft. of floor space. The company plans to use the new plant for the manufacture of fan motors. This will relieve the congestion at the three other plants owned by the company.

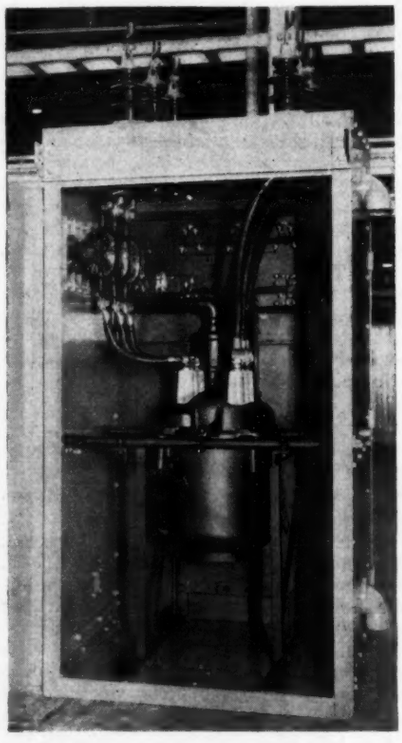
The Pennsylvania Pump & Compressor Company, Easton, Pa., announces that it is now equipping its horizontal double-acting air compressors with the "Texrope" short belt drive manufactured by the Allis-Chalmers Manufacturing Company of Milwaukee.

Porcelain Products, Inc., Findlay, Ohio, announces that the National Electric Porcelain Company of Carey, Ohio, and not the National Porcelain Company of Trenton, N. J., is a part of the recent merger of porcelain companies as mentioned in the July 30 issue of the ELECTRICAL WORLD.

New Equipment Available

Outdoor Switchhouse

Several changes in its line of switchhouses, the most prominent of which is the reduction in height which is said to give a more compact single unit and also allows ready mounting under existing structures and buses, have been made by the Westinghouse Electric & Manufacturing Company. Complete isolation of the front from the rear of the houses has also been accomplished without decreasing accessibility. The unit is thus entirely dead front. The meters and relays are now mounted on steel instead of slate panels which also provide additional bracing to the housing as well as eliminating the possibility of panel breakage. The circuit-breaker control relay is mounted in a glass case thus removing all danger of contact with live parts in the front of the switchhouse.



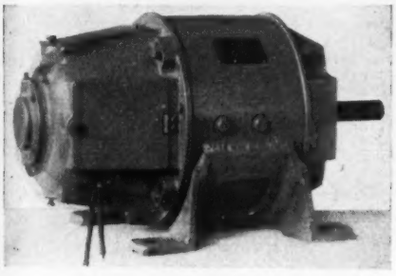
REAR VIEW OF OUTDOOR SWITCHHOUSE, INCLOSING DOOR NOT SHOWN

Cable Splice and Dead End

A new cable splice and a new dead end have been recently introduced by the Ohio Brass Company, Mansfield, Ohio. The cable splice consists of two cones and two chucks connected by a coupling, one threaded right-hand, the other left, with space provided for tightening with a spanner wrench. The dead end is made up of a cone and a chuck with a clevis for connecting to dead-end insulators. A zinc head molded on the end of the cable bears against the chuck, and the strain on the cable pulls the chuck into the cone compressing it on the cable and holding it firmly in place. The gripping action of the chuck increases with increased tension and will withstand the maximum strain of the cable for which it is built. All strands of the cable are said to bear their proportionate share of the load, because after the cone and the chuck are slipped over the cable the ends of the strands are spread and cleaned with emery cloth and tinned by dipping into molten zinc, with a flux of pure sal ammoniac. The mold is then clamped to the end of the cable and a zinc head is made which holds the ends of the strands. The dead end is made of high strength smoke resisting bronze. Both the dead end and the cable splice are made in sizes to fit all cable from ½ in. to 1 in. in diameter.

Inclosed Hoist Motor for Mines

A new type RH, totally inclosed motor, rated at 5 hp., 15 min., 55 deg. C. temperature rise, 1,150 r.p.m., compound wound, 115, 230 or 550 volts, has been developed by the Westinghouse Electric & Manufacturing Company particularly for use on portable type room hoists in mines. Across-the-line starting is permitted with negligible disturbance at the commutator. The armature coils are so constructed and installed that a single coil can be replaced with a minimum disturbance of the other coils. Each coil is specially insulated and the completed armature is thoroughly impregnated and baked. The shunt and series coils for



TYPE R H TOTALLY INCLOSED MOTOR FOR USE ON PORTABLE TYPE ROOM HOISTS IN MINES

one pole are assembled as one unit and are dipped and baked in this form. The manufacturer states that special precautions are taken to insulate the coils from each other and from ground.

The motor has a rolled steel frame and drop forged steel feet which are welded to the frame. The bearings are heavy-duty roller type and the motor can be operated in an inclined position. The four inclosing covers, as shown in the illustration, are hinged to the bracket and can be raised for inspection of the brushes and commutator by loosening one screw.

Protective Paint

A new red protective paint which prevents gas, oil and water leaks and can be applied by brushing or dipping, requires no priming and produces a hard, smooth and glossy film has been developed by the General Electric Company for use on parts of direct-current motors which are subject to acids, alkalies, oil or dust. This paint is used on the ends of the commutators and between the ends of the commutator bars and comb, to prevent the entrance of oil, moisture, carbon and copper dust.

The company states that a number of mining concerns in the central Pennsylvania field are using the paint on storage battery locomotives when a new battery is installed. The battery box, container, and top of the cells and terminals are given a liberal coat to prevent corrosion. The field coils on direct-current pump motors, which are exposed to oil and moisture and the stators of induction motors are also being painted by several users. A coal-mining company has also used the material for protecting the motors of mine locomotives and in another instance the paint has been used to protect the underside of automobile mudguards. The paint is known as the No. 880 red protective paint and is handled by the merchandise department of the General Electric Company at Bridgeport, Conn.

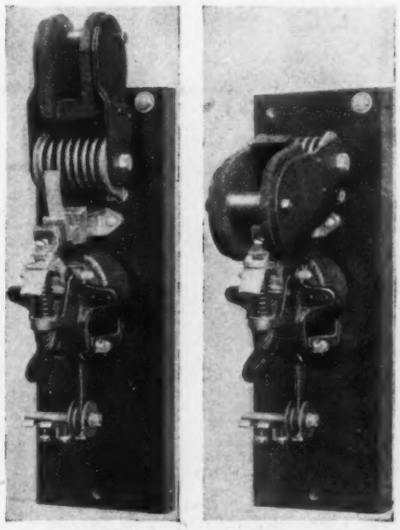
New Metal and Semi-metal Brush Material

Brush material composed of pure copper and graphite, without a coke residue as a binding medium, has been made available by the Keystone Carbon Company, Emporium, Pa. It can be produced in a wide range of proportions which makes available a special combination for each individual application. The most important characteristic is exceptionally low electrical resistance with a very high graphite content. Shunts are an integral part of the brush, they being actually added to and processed with the raw material. This product has also been applied where metal brushes were heretofore out of the question.

Magnetic Blowout Contactor

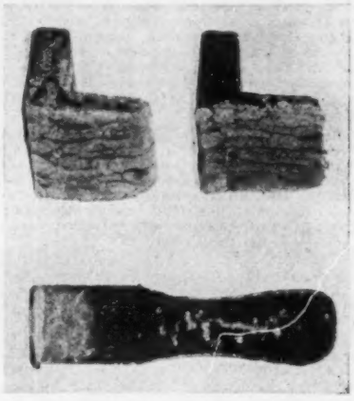
Improved designed magnetic blowouts on its direct-current mill type contactors have been developed by the Cutler-Hammer Manufacturing Company, Milwaukee. In developing this new contactor actual life tests were conducted to determine the effect of the shape and the material used in the contacts themselves, the shape and material of the arcing tips, the location and intensity of the magnetic blowouts, and the material used for the magnetic blowout shields.

A 300-amp. type No. 142 butt-contact-type mill contactor, operating at 200 per cent load alternately making and breaking a 600-amp. 250-volt circuit, gave an average life of 263,000 operations for each set of contacts. One result noted during these tests was the fact that instead of decreasing one third in life after each renewal, as is usually the case, the contacts actually increased in life. The tests covered



TYPE 142 300-AMP. MILL TYPE CONTACTOR WITH NEW DESIGN MAGNETIC BLOWOUT

2,000,000 operations requiring eight renewals of contacts. Whereas the first set of contacts gave only 222,239 operations the sixth set had a life of 261,130 operations, the seventh set 275,859



A PAIR OF 300-AMP. CONTACTS AND AN ARCING TIP AFTER 315,000 OPERATIONS AT 600 AMP.

and the eighth set 265,023 operations. At the end of the 2,000,000 run, the blowout shields were still in excellent condition and good for at least two million additional operations. The effect of 315,000 operations at 600 amp. on a pair of contacts and an arcing tip is shown in the illustration. These contacts were taken from a 300-amp. contactor.

Voltage Relay Alarm.—A voltage relay alarm which will ring a bell for two minutes when power goes off and a buzzer for 15 sec. when power returns, has been placed on the market by the Iler Electric Service Company, 917 Hillman Street, Youngstown, Ohio. The alarm is foolproof, and it has no batteries or switches which must be operated. It consumes three watts. The standard operating voltage is 110 but it can be supplied for other voltages as well as for different time intervals of operation.

Traffic Signal Mechanism.—Two new types of traffic signal mechanism, introduced by the General Electric Company, and known as forms 52 and 53 "novalux" traffic control boxes, consist of a cast-iron box containing a timer, two snap switches, a fuse block and fire relay. One snap turns the signals on and off while the other switch, labelled "amber" turns on a flashing amber indication for late evening hours when the flasher is not used as a regulating device. A fire relay mounted on jack plugs is included in the control box so that remote fire control may be obtained.

Circuit Tester.—A circuit tester for locating open circuits in coils and circuits of all kinds has been placed on the market by the Roller-Smith Company, 237 Broadway, New York City. The instrument shows directly the approximate resistance of the coil or circuit up to a range of 10,000 ohms. It is small and the manufacturer states that it is compact, rugged and thoroughly dependable. It uses a small standard flashlight cell that is self-contained.

New Trade Literature

STATIC CONDENSERS.—Leaflet 20286-A, covering static condensers for power-factor correction on motor circuits, has been issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. It contains descriptions and illustrations of the various types of condensers and tables giving the corrective kva. required for various ratings of three-phase squirrel-cage motors.

METERS, SWITCHES AND CUT-OUTS.—The General Electric Company, Schenectady, N. Y., is distributing bulletins GEA-784, GEA-765, GEA-597A and GEA-732, covering its single-phase watt-hour-meter, type 1-16, CR7006-D20 magnetic switch, push- and pull-button control switches and "D & W" oil-fuse cut-outs, type D, respectively.

COAL-DUST COLLECTOR.—"Collecting Fly-Ash and Coal Dust" is the title of bulletin No. 1028 issued by the American Blower Company, Detroit, Mich. It contains an illustration and description of the type D "sirocco" collector, as well as an actual test curve showing the efficiency.

TURBO-GENERATOR SETS.—The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-598, describing its turbo-generator sets from 2,000 kw. to 6,000 kw. Illustrations are given showing typical installations, and a cross-section of a turbine and its construction details are also included.

SAFETY SWITCHES.—Catalog No. 17 issued by the Trumbull-Vanderpoel Electric Manufacturing Company, Inc., Bantam, Conn., describes and illustrates its complete line of industrial switches, motor-control switches, meter-service switches, fuse panels, etc. Oscillograms and photographs compare the performance of the company's line of current breakers as compared with a standard type A safety switch. Wiring data for direct-current and squirrel-cage motors are included.

BUS SUPPORTS.—The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-721 covering its indoor bus supports, porcelain-post insulator type for 7,500, 15,000 and 25,000 volts.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

INDIAN ORCHARD, MASS.—Plans are under consideration by the Orchard Business Association for the installation of an improved lighting system on Main Street.

THOMPSONVILLE, CONN.—The installation of a lighting system in the business district and on portions of Pearl and Main Streets is under consideration.

Middle Atlantic States

JORDAN, N. Y.—The Jordan Electric Light & Power Company has applied for permission to extend its transmission lines in the town of Elbridge and for approval of a franchise granted by the Town Board for a term of 50 years.

MONROE, N. Y.—The Orange & Rockland Electric Company has petitioned for authority to extend its electric lines in the towns of Warwick, Chester and Woodbury.

CAMDEN, N. J.—Plans for the proposed new units of the Campbell Soup Company to be erected at Cooper and Linden Streets, at a cost of $2,000,000, include a power plant.

MILLBURN, N. J.—The Millburn Township Committee is considering establishing an ornamental lighting system on Millburn Avenue. The Jersey Central Power & Light Company will install the lights.

HARRISBURG, PA.—Bids will be received by the Department of Property and Supplies, Capitol Building, until Sept. 27, for electrical supplies for a period of six months dating from Oct. 15, 1927, to April 15, 1928.

HOLTWOOD, PA. — The Pennsylvania Water & Power Company, with which the Holtwood Power Company is to be merged, is planning extensive additions to the steam plant here.

PHILADELPHIA, PA.—Application has been made by the Philadelphia Electric Company for the authority to erect two transmission lines across Montgomery County near Bridgeport. The company also plans the construction of a transmission line in Chester County.

SOUTH HILL, VA.—The Virginia Public Service Company, Richmond, which has acquired the local municipal power plant, plans extensions and improvements, including transmission line construction.

North Central States

GRAND HAVEN, MICH.—The City Council plans extensions and improvements to the municipal electric light and power plant, to cost about $30,000.

CINCINNATI, OHIO.—The City Council is considering a petition asking for the installation of ornamental lamps on Vine Street, between McMillan and St. Clair Streets.

YOUNGSTOWN, OHIO.—Extensions and improvements are contemplated by the Pennsylvania Ohio Power & Light Company to its plants and system in this section to cost about $5,000,000.

SPRINGFIELD, ILL. — Bonds to the amount of $4,642,000 have been issued by the Central Illinois Public Service Company, a portion of which will be used for extensions and improvements in power plants and system.

MAQUOKETA, IOWA.—The Iowa Electric Company, Cedar Rapids, plans to erect a new high-tension line from Maquoketa to Delmar.

LAMAR, MO.—Work will begin shortly on the construction of a new municipal electric light plant to cost about $63,000. Albert C. Moore, Joplin, is engineer.

Southern States

FAIRPLAINS, N. C.—The Southern Utilities Company, Charlotte, plans the construction of a transmission line from North Wilkesboro to Fairplains and vicinity for local commercial service.

DECATUR, GA.—Plans are under way for the installation of an ornamental lighting system in the business district. The Chamber of Commerce is at the head of the project.

UVALDA, GA.—The Georgia Power Company, Atlanta, will erect a 150-kva. substation and a 2,300-volt, three-phase distribution system.

KNOXVILLE, TENN.—Plans are being prepared by the Knoxville Power Company for the construction of a hydro-electric generating plant on the Little Tennessee River, with initial capacity of about 80,000 hp. A power dam and transmission line will be built. The cost of the project is about $900,000. James W. Rickey, 2400 Oliver Building, Pittsburgh, is engineer.

ANDALUSA, ALA.—The Andalusa Light & Power Company plans the rebuilding of the portion of its power plant, destroyed by fire, with loss reported in excess of $75,000.

BIRMINGHAM, ALA. — The Alabama Power Company plans the construction of a new hydro-electric power plant on the Warrior River at Lock 17, to cost about $1,200,000. A transmission line will be erected to Tuscaloosa.

GANTT, ALA. — The Gantt Light & Power Company has applied to the Alabama Public Service Commission for authority to construct a distribution system.

MILO, ALA.—The Pea River Power Company, Troy, Ala., plans the construction of a transmission line to Milo, Banks and vicinity for local commercial service.

MALVERN, ARK.—Plans are under consideration by the City Council for the installation of a municipal electric light and power plant.

KINDER, LA.—The Gulf States Utilities Company, Lake Charles, contemplates the construction of a transmission line from Elton to Kinder.

HOLLIS, OKLA.—Plans have been approved by the City Council for the installation of an ornamental lighting system in the business district.

FAYETTE, TEX.—The Central Power & Light Company, San Antonio, plans the erection of a transmission line from Fayette to Harwood and vicinity, to connect with line at Luling.

Pacific and Mountain States

HUNTINGTON BEACH, CAL.—Bids will be received by the City Council until Sept. 6, for the installation of an ornamental lighting system, with underground conduit lines, on Main Street from Ocean to Mansion Avenues.

LONG BEACH, CAL.—The Pacific Coast Steel Corporation, San Francisco, plans the construction of a substation at its proposed local steel mill in the Harbor district to cost about $1,000,000.

LOS ANGELES, CAL.—The City Council has authorized plans for the installation of an ornamental lighting system on the West Boulevard and Hillcrest Drive, between Washington and Adams Streets, using concrete standards.

AMERICAN FALLS, IDAHO.—Plans are under way by the United States Bureau of Reclamation, Wilda Building, Denver, Col., for the construction of a new hydro-electric generating plant, for which an appropriation of $700,000 has been made by Congress. Raymond F. Walter is engineer.

MIDVALE, UTAH. — Plans are under consideration for the installation of an ornamental lighting system in the business district.

YUMA, ARIZ. — Application has been made by the Yuma County Water Users' Association, for permission to build a hydro-electric power plant at the Laguna Dam, to cost $1,500,000, with transmission system.

Electrical Patents

Announced by U. S. Patent Office

(Issued Aug. 2, 1927)

1,637,887. VOLTAGE REGULATION OF EXCITERS; R. M. Wilson, Montclair, N. J. App. filed March 26, 1914.

1,637,913. SWITCH HANDLE; A. H. Nero, New Britain, Conn. App. filed March 31, 1921.

1,637,989. MACHINE FOR MAKING GLASS MOUNTS; C. Eisler, Newark, N. J. App. filed March 5, 1926. For radio tubes, incandescent light bulbs and the like.

1,637,991. PRIMARY BATTERY; G. S. Engle, Washington, D. C. App. filed March 6, 1926. Having an alkaline electrolyte.

(Issued Aug. 9, 1927)

16,700 (reissue). LOCOMOTIVE; S. W. Farnham, Chicago, Ill. App. filed April 6, 1927. Mine locomotives with means for preventing sparking between the locomotive wheels and the rail while the power is being supplied through a cable reel.

1,638,024. ARC-WELDING MACHINE; H. R. Woodrow, New York, N. Y. App. filed June 18, 1919. Automatic.

1,638,085. THERMOSTAT; J. O. Carrey, St. Louis, Mo. App. filed May 1, 1925. For operating an electric switch in a predetermined relation with the temperature.

1,638,098. RELAY; H. C. Rochette, Waterbury, Conn. App. filed Nov. 22, 1921. A magnetically controlled relay in which the difficulties due to sluggish action are obviated.

1,638,103, 1,638,104, 1,638,105. SYSTEM FOR TRANSMITTING OR MEASURING VARIABLE CONDITIONS; E. Roucka, Blansko, Czechoslovakia. Apps. filed Feb. 6 and Aug. 9, 1923, and Jan. 15, 1924.

1,638,123. CIRCUIT CONNECTER; R. D. Mailey, East Orange, N. J. App. filed Feb. 1, 1924. Of the liquid-flow type.

1,638,130. LIQUID-FLOW TIME SWITCH; W. R. Walker, New Dorp, New York, N. Y. App. filed June 26, 1924. In which there is a time lag in the circuit-making motion.

1,638,131, 1,638,132. ELECTRIC SWITCH; W. R. Walker, Great Kills, N. Y. Apps. filed March 5, 1925, and Feb. 15, 1926. Of the liquid-flow type; methods of mounting the electrodes in the switch.

1,638,133. ROTATING CYLINDRICAL GLASS MERCURY SWITCH; W. R. Walker, Bloomfield, N. J. App. filed Jan. 20, 1927.

1,638,174. APPARATUS FOR TESTING MAGNETIZABLE OBJECTS; E. Stoughton, Bethlehem, Pa. App. filed Jan. 19, 1924.

1,638,239. DRIVING MECHANISM AND METHOD; T. A. Bryson, Troy, N. Y. App. filed Feb. 12, 1921. For a load to be driven at widely varying speeds.

1,638,240. SAFETY ELECTRIC DOOR OPENER; P. A. Caron, Detroit, Mich. App. filed May 7, 1925.